Ave D.C.

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nology): P (Physical Oceanography); S (Acoustical Oceanography); X (Other).

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which submittal is made. 6. Indicate your preference for a particular kind of presentation by one of the following letters: O, oral; P, poster. The chairman may assign you to either of these types of presentation in order to fit his or her pro-

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Poster Sessions

A large, centrally located meeting room will be set up for poster presentations. Experience from recent AGU meetings and from other scientific societies has shown that a poster presentation, while more demanding of the author, can provide a superb opportunity for comprehensive discussions of research results

If individual papers are deemed by a program chairman to be suitable for this type of presentation, they may be so assigned.

Presenters of poster papers are reminded that a poster exhibit requires careful preparation. Figures and text will be scrutinized in detail, and authors must be prepared to discuss the contents of their papers in depth. Under these conditions, well-prepared figures and concise, logical text are essential.

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ASA Robert S. Winokur, ONR ASLO Mary Jane Perry, University of Washington
M75 Ned A. Ostenso, NOAA

Special Sessions

Warm Core Rings Air-Sea Interaction in Coastal Regions Shelf Dynamics: CODE Optical Dynamics Experiment Marginal Ice Zone Experiment California Current Gulf of Mexico/Caribbean: Biological, Ches cal, and Physical Oceanography Southern Oceans: Dynamics, Biomass

Arctic Ocean: Dynamics, Biology, Acoustic Scalloor Spreading Centers El Niño and Climate Variability El Chichon, Global Climate, Chemistry

Oceans and Atmospheric Chemistry: CO2 Ocean Heat Transport: Climate, Paleochim Acoustic Monitoring: Suspended Parlinger

Acoustic Remote Sensing: Fine Structure, in ternal Waves, Mesoscale Features Acoustic Imaging: Seafloor, Precision Acoustic Tomography

Large-Scale Ocean Observing System SAR Surface Signatures Ocean Tracers Radioactive Disposal Environment and Fisheries Year Class Sura

Zooplankton Behavior Plankton Growth Rates in Oligotrophic Wa

Below Ground Processes in Wedland Econt Phytoplankton Responses to Fluctuating Es

Aquatic Nitrogen Cycles Interrelation of Optical and Biological Prop Dynamics of Microaggregates in Oceanic 54 Organism Growth and Behavior in a Tirle

Biology and Physics of the Benthic Boundary Feeding Ecology of Fishes Cyanobacteria: What Are They Doing?

IUGG Quadrennial Report Overview

Solar-Planetary Relationships: Aeronomy 1979-1982

Richard S. Stolarski

NASA/Goddard Space Flight Center, Greenbelt, MD 20771

Aeronomy is the study of the physics and themistry of the upper atmosphere. The upper atmosphere is usually defined as the region of the atmosphere above the tropopause extending upward to the point where electric and magnetic fields dominate the phenomena rather than the atmospheric atoms and molecules. The lower part of this region, from about 10 to 90 kilometers altitude, has become known as the middle atmosphere. An international program called MAP (Middle Amosphere Program) is now underway to inlensively study this region. Three reviews of work in the middle atmosphere appear in this volume covering the composition, dynamics, and electrodynamics. Susan Solomon's paper. "Minor Constituents in the Stratosphere and Mesosphere," documents the continued growth in knowledge concerning the compo-ation of the middle atmosphere, the mecha-

its possible response to outside influences. Dennis Hartman's review, "Middle Atmosphere Dynamics," examines the large-scale dynamics and climatology of the middle atmosphere, particularly pointing out the im-portance of the introduction of transformed Eulerian mean equations for dynamics and transport and the realization of the importance of gravity waves for the momentum budget of the stratosphere. Michael Kelley's review, "Middle Atmosphere Electrodynamics," discusses a variety of new techniques that have been used to obtain "existing and controversial" results including large (several volt/meter) fair weather electric fields in the

Above the middle atmosphere is the region referred to as the thermosphere or ionosphere, depending on which properties of the region are being emphasized. The review of this region is again divided into several pa-pers. Douglas Torr's "Neutral and Ion Composition of the Thermosphere" summarizes the continued advances in the understanding of how solar extreme ultraviolet radiation in teracts with and determines the composition and structure of the thermosphere. He emphasizes the significant contributions of the Atmosphere Explorer Satellite series. Raymond Roble, in "Dynamics of the Earth's Thermosphere," puts his emphasis on ques-tions concerning the global circulation, temperature, and compositional structure of this highly variable region. "Ionospheric Electro-dynamics and Irregularities" are covered by Arthur Richmond with emphasis on the modeling and data concerning the global electric

circuit. Thus both the middle atmosphere and the thermosphere are described in three reviews emphasizing different aspects of the physics and chemistry of the respective re-A further report, "U.S. Contributions to

Auroral Aeronomy, 1979-1982" by M. H. Rees, is devoted mainly to the special aspects of the thermosphere which are initiated in the auroral region by particle precipitation. Finally, the "Aeronomy of the Inner Planets" by Toin Cravens and Andrew Nagy covers the recent advances in understanding of the thermospheres of Mars and Venus, providing a summary of the recent Pioneer Venus re-

Contents: IUGG Quadrenuial Report Solar-Planelary Relationships: Aeronomy

and A. F. Nagy Middle Atmospheric Electrodynamics, M. C.

Report to the IUGG, 1979-1982; Solar-Planetary Relationships: Aeronomy, R. S. Dynamics of the Earth's Thermosphere, R. G.

Ionospheric Electrodynamics and Irregularities: A Review of Contributions by U.S. Scientists From 1979 to 1982, A. D. Rich-

U.S. Contributions to Auroral Acronomy, 1979-1982, M. H. Recs

Neutral and Ion Composition of the Thermosphere, D. G. Torr Aeronomy of the Inner Planets, T. E. Gravens

U.S. National Report to **IUGG 1979–1982**

Eos is periodically publishing the 12 overviews appearing in the U.S. National Report to the International Union of Geodesy and Geophysics 1979–1982. The U.S. National Report is being published by AGU on behalf of the U.S. National Committee in four extra issues of Review of Geo physics and Space Physics (RGSP). The discipline overview appearing here was published with its associated papers (see Contents list at the end of he overview) in volume 21, mumber 3, March 1983 of RGSP.

Subscribers to RGSP will automatically receive Substrikes to KGSP issues containing the U.S. National Report. All four extra issues will have been mailed by July 1983. The tour regular issues of RGSP are appearing as usual in February, May, August, and November. Those who do not substribe to RGSP can still obtain the entire U.S. National Respective to Action of the property and service. tire U.S. National Report by entering a subscrip-tion to RGSP. In addition, the report of each discipline will automatically be mailed separately those members of AGU for whom that discipline is their primary AGU section afhliation; this separate distribution is made possible by grants from the Defense Mapping Agency, Na-ional Aeronautics and Space Administration, National Oceanic and Atmospheric Administra-tion, National Science Foundation, Office of Naal Research, and U.S. Geological Survey.

Minor Constituents in the Stratosphere and Mesosphere, S. Solomon

Middle Annosphere Dynamics, D. L. Hart-

<u>News</u>

Arctic Air Chemistry: Haze Analysis

The microparticulate (i.e., aerosol) and gas concentrations in Arctic air masses are being assessed currently as a result of a large-scale. ultinational cooperative study made this spring. It turns out that many of the ideas about the origin of Arctic haze, industrial pollution, soil particles from the great descritegions of eastern China and Mongolia, and seasonal effects, to name a few, may all be valid. A recent report about the first extended airborne measurements of Arctic haze that were made during March and April of this year stated: "Most of the scientists on board the NOAA plane found the haze to be much denser and more extensive than they anticipated" (Environ. Sci. Technol., June 1983). be results of WP-30 Orion research aircraft flights over the Arctic ice cap suggest that in e locations the haze extends upward of 8.5 km at this time of the year. The haze was found to exist at all latitudes in the northern polar region with unbroken continuity to an altitude of approximately 3 km. At higher al-titudes there was a banding of discontinuous

According to the report, the Arctic haze is subject to climatic and seasonal factors that are characterized by pollution indicators: primarily, sulfate control of the cont maily, sulfate concentrated at 2 µg/m³, organic carbon concentrated at 1 µg/m³, and black carbon (soot) concentrated at 0.3-0.5 gm3. Of these, the soot particles are the ally ones created by combustion processes. esert soil-derived aerosols can be distinsuished from pollutants by their aluminum oncentrations (pollutants are relatively aluminum free) and by their vanadium-aluminum aum ratios. Evidently, vanadium is richer in sollutants derived from the burning of heavier, less expensive oil fuels (too viscous to be Jumed conveniently at Arctic air temperalures). The vanadium-aluminum ratios of such pollutants can be 1 or more orders of magnitude higher than those characteristic of soil-derived aerosols.

The NOAA flights took off from Anchorage, Alaska: Thule, Greenland; and Bods, forway; they concentrated their routes within 70°-90°N latitude, which passed some of them over the structure of hem over the North Pole. A University of Washington plane took off from Point Bar-tow, Alaska, and German and Norwegian planes departed from Spitzbergen, Norway. Thirteen university groups were involved in the joint effort with CIRES (Cooperative Institule for Research in Environmental Scitaces). Other government agencies involved besides NOAA (National Ocean and Atmospheric Admir (National Ocean and Atmospheric Admir (National Ocean) spheric Administration) were: NCAR (Na-lonal Center for Atmospheric Research), NASA (National Atmospheric Research) NASA (National Aeronautics and Space Administrational Aeronautics and Space Administrational Aeronautics and Space Administrational Aeronautics and Space Administration Aurospherical Aeronautics and Space Administration Aeronautics Aerona inistration), DOE (Department of Energy), NIAR (Norwegian Institute for Arctic Re-earch), and AES (Canadian Atmospheric avironment Service). Thus the study had an inusually large number of groups involved,

and it generated large numbers and types of air chemistry measurements.

The results of these studies will be presented at the third Symposium on Arctic Air Chemistry, to be held in May 1984 at Toronto. Within the myriad character of Arctic air patterns (chemistry, seasons, and climate) can be found the pleasant fact that at times of the year—late spring and summer—the Arctic is free of pollution and haze; the air is pristine and clear. During that period, aerosols and lutants are scavenged and the atmosphere s clean because of its remoteness from major polluting sources. By late October, however, the Arctic air dries, and air masses containing the emissions from industrial sources far away are transported slowly over the northern polar region — PMB

Lost Island Found

An abandoned 11-by-5-km kidney-shaped chunk of freshwater ice, used as a research station for 25 years, was rediscovered after the National Oceanic and Atmospheric Administration (NOAA) lost track of the island for 6 months. The recent find may foreshad ow another loss, however: The island is drifting through the Greenland Sea and into the North Atlantic where it should melt within several months and dump its cargo of oil drums, equipment, and a wrecked plane into

the ocean. Known as Fleicher's Ice Island-after Joseph O. Fletcher, a member of the first team of researchers to inhabit the island and a recently retired NOAA climate researcher—the ice chunk has already melted to a third of its original 49 m thickness. A pilot flying over the area to measure annual pollution buildup in the Arctic located the drifting island 242 km from the North Pole near the Interna-

Identified by Fletcher as a fragment of the Ellesmere Island ice shelf, the island was the home for a number of Air Force, Navy, and NOAA scientific teams that provided weather reports and conducted experiments. Before satellites superceded the research and forecasting functions of the teams on Fletcher Island, the station also was a valuable site for observing oceanic and aumospheric circula-tion. First occupied in 1952, the island was abandoned in the mid 1970s.

In addition to its historical significance to scientific research, the site gained notoriety when a man on the island lost his life in an argument over a bottle of wine.

New Climate Center

An Experimental Climate Forecast Center has been established at the NASA Goddard Laboratory for Atmospheric Sciences (GLAS) by the National Oceanic and Atmospheric Iministration's (NOAA) National Climate Program Office. NASA's Goddard Labora, tory will provide the computing facilities nec-

essary to process the vast amount of data used in complex numerical climate modeling. As the second of the centers established

under the National Climate Program Act of 1978, the Experimental Climate Forecast Center will investigate climate predictability theory and forecasting techniques by using numerical methods in dynamic models of the earth's ocean and atmosphere system. The first center, at the Scripps Institution of Oceanography, concentrates on statistically based methods. The principal interest of both centers is the potential for forecasting characteristics of seasonal temperature and precipitation. The director of the new center is Milton Halem; he also will continue as head of the global modeling and simulation branch at

NOAA's National Climate Program supports research on improving forecasts of next season's and perhaps next year's weather to aid planning for crop fertilization and irriga-tion schedules, geographical distribution of heating fuel, and maintenance of urban fresh water supplies.—BTR

NASA FY1984

The White House budget request for the National Aeronautics and Space Administration (NASA) for fiscal year 1984 contains a number of continuing problems for outside investigators in universities and in the private sector. Nonetheless, the budget climate for NASA seems to be improving. (For more information on the budget for FY1984, see Eos, February 15, 1983, p. 65, and May 17, 1983,

. 578.) Several new program starts are responsible for the feeling of optimism being sensed in many sectors of the scientific community. These include the Venus Radar Mapper, a shuttle-tethered satellite to study the earth's km in length), and the EUVE experiment (Extreme Ultraviolet Explorer).

The problems that remain in the budget are unfortunately rather focused on the geophysics academic community. For example, research and analysis funds are reduced in the FY1984 request to about what they were in the FY1983 request because Congress restored the funds cut last year. This year, the battle is going on again in both Houses, and at this point it appears as though the cut funds may be replaced again, particularly if Congress is supported by the scientific community as it was last year.

In FY1983, the research and analysis appropriation was \$50.3 million. This fiscul year it is down to \$45.5 million, but by mid-August the new appropriation may restore the cut. The budget request overall is set by the Office of Budget and Management at \$7.106 billion, which is an increase of 3.75%.

The space science portion of NASA's bud-et has been boosted significantly for FY1984 y about 14%. The Gamma Ray Observatory back on a schedule with a launch date of 1988. The Venus Radar Mapper will fly also in 1988, to be launched by using the shuttle-Centaur apperstage. The Galileo mission is to

be faunched by Centaur in 1986 and will arrive at Jupiter in 1988.

NASA will not send its half of the two-satellite experiment in the 1986 launch of the International Solar Polar mission. Funds are being aimed at supporting the remaining sin-gle spacecraft of the European Space Agen-

Hess Centennial

June 24 marked the 100th birthday of Victor F. Hess, the discoverer of cosmic radiation. The Austrian-born scientist received the Nobel Prize in physics in 1936 with Carl Anderson of the California Institute of Technology, who discovered the positron. When he died in 1964, Hess had more than 150 arti-

cles and publications to his credit. In 1910, while a lecturer at the University of Vienna. Hess launched an unusual series of experiments to measure the conductivity of air. He made 10 balloon ascents, half of these at night. On the basis of these experiments, he concluded that "radiation of very high penetrating power enters our atmo-sphere from above." One ascent made during a solar eclipse proved that the sun could not be the main source of cosmic rays.

Hess made his first trip to the United States in 1921. Under his supervision, a research laboratory, the United States Radium Corporation, was built in New Jersey; he served for 2 years as the corporation's director and chief physicist.

Hess then returned to Austria to the University of Graz, where he later became dean of the faculty. He accepted a position at the University of Innsbruck in 1931 and established a laboratory for the observation of cosmic radiation there. Six years later he returned to Graz, In 1938, after Hitler's Germany annexed Austria, Hess fied with his wife, who was Jewish, to Switzerland. While in Geneva. Hess was offered a full professorship by Fordham University. He accepted and proved back to the United States. Hess retired from Fordham in 1958.



Victor F. Hess.

The VGP News



Editorr Bruce Doe, 11721 Dry River Court, Reston, VA 22091 (telephone 703-860-8470, after 5:30)

Sigurdur Thorarinsson 1911-1983



In March 1875 a number of farms were abandoned in eastern Iceland as a consequence of the great eruption of Askja vokaio. The abandonment of one tarm, however, had to be delayed as the family was expecting a child. In the spring a son was born. He was Thoraring, the father of Sigurdur Thorarins son. This incident is merely one example of the dynamic interaction between man and nature which is so typical of Iceland. Here the geological mill, fueled by vigorous volcanism, glaciers, and swift rivers, grinds faster than elsewhere on earth. Here the existence of a small nation is continually responding and adjusting to the environmental pressures generated by rapid and sometimes cutastrophic

Sigurdur Thorarinsson died in Reykjavik on February 9, 1983, at the age of 71, following a brief illness. Born on January 8, 1912, he was the leading Icelandic earth scientist o the 20th century and acquired international renown for his research in volcanology. The list of accomplishments of this remarkably versatile man is indeed impressive. He pioneered the development of tephrochronology as a branch of earth science, first as a tool in archeological research and later as a key to the volcanic history of Iceland. The fruits of this research included a monograph on the cruptions of Hekla in historical times and led to the important discovery of a regular relationship between the length of repose period and the silica content of Hekla's magnas.

Sigurdur witnessed or studied all volcanic eruptions in Iceland since 1934. Probably no other scientist has accumulated comparable field experience on active volcanoes. His accounts of the birth and growth of the volcanic island of Surtsey are classics in volcanological research and clarified our understanding of the role of seawater in hyaloclastite formation, the characteristics of base surge activity, and the evolution of table mountains. He immediately embraced the concepts of plate tectonics and applied them to interpretation of the structure of Iceland as early as 1965. He also made important advances in glaciology and contributed to the understanding of the relationship between geothermal activity in subglacial volcanoes and periodic jokulhlaups or glacier-bursts. His works in the fields of geomorphology and soil erosion further emhasize the breadth of his interests,

Signratur maintained a remarkable produc tivity through the years, and published well over 200 papers and books. At the time of his death Sigurdur was preparing manuscripts on the 1783 fissure eruption of the Laki cra-ter-row and its atmospheric effects on the northern hemisphere. Other works in progress included the volcanic history of Iceland and the long-awaited Iceland volume of the Catalogue of Active Volcanoes of the World. These compilations represent a life-time labor of love but were continually being updated to include new research and new cruptions. It is hoped these works will be pub-

Sigurdur Thorarinsson studied in the Uniersity of Copenhagen and the University of Stockholm, where he completed a classic doctoral dissertation in 1944 on the tephrochronology of Iceland. He returned to Iceland and became director of the Geology Department of the Museum of Natural History in 1947 and the first professor of Geology in the University of Iceland in 1968.

Another side of Sigurdur's personality, not generally known to his foreign colleagues, was his work as a poet and songwriter. He wrote hundreds of witty poems, which have become part of the Icelandic folksong tradition. His poetry, good humor, and inexhaust-ible energy in informing the general public about geological processes made him lee-land's favorite son. Signrdur was never a controversial figure; his innovative research was always solid and has stood well the test of time. He was fair and unselfish and generously shared his ideas with colleagues, who always held him in highest regard. His death is a great loss to the science of volcanology.

This tribute was written by Haraldur Sigurdsson of the Graduate School of Oceanography, University of Rhode Island, Kingston, Rt 02881.

Welcome to The VGP News

Scope of the Section

Beginning with this issue of Eas, the Volcanology, Geochemistry, and Petrology Section of AGU will publish brief and timely scien-tific reports, highlights of conferences, statements of opinion, section news, and other topical information approximately every 3 months in a new section of Eos called "The VGP News."

Material for The VGP News will be handled by Eas Editor Bruce R. Doe. VGP Section President J. V. Smith has appointed the following editorial group to work with Doe:

Peter W. Liuman, VGP Secretary, U.S. Geological Survey, MS 913, Federal Center, Denver, CO 80225 (telephone: 303-234-2901) Charles A. Wood, SN4-NASA Johnson

Space Center, Houston, TX 77058 (telene: 713-483-3816) William P. Leeman, Department of Geology. Rice University, Houston, TX 77001 (tele-

phone: 713-527-4880) Joseph R. Smyth, 156 Piedra Loop, Los Alamos, NM 87544 (telephone: 505-672-

> Peter W. Lipman Secretary, VGP

VGP Opportunities

It is a great pleasure to introduce this first edition of The VGP News. I have enjoyed greatly the reports from the Oceanography section and was delighted to find that Brent Dalrymple and Peter Lipman were equally enthusiastic for starting a VGP equivalent. Chuck Wood has provided a very useful service with his Volcano News, and he plus Bill Leeman and Joe Smyth have the enthusiasm and general knowledge to put together valu able news items. But they will need the help of other members of the section in their

Our section faces major problems in capi-talizing on the remarkable growth of knowledge and techniques. We need to integrate the laboratory and field aspects of our sciences. The new techniques, such as high-energy mass spectrometry and synchrotronbased experiments, will put further pressure

on funding.

Our section could provide a useful public service by providing reliable information on geological hazards along with advice on the uences of various social and political choices. We could also discuss the problems of the fractionation of the earth sciences into so many subgroups and possible ways of providing increased cooperation between them

(e.g., the various geochemical-based societies). On behalf of the whole section, I wish the editors and secretary all the best in this venture and thank them for their labors.

Joseph V. Smith

President, VGP

News & Announcements

New Crater in Costa Rica

On April 9, 1983, we discovered a new exdosion crater buried in the thick rain forest that covers the Hanks of Arenal volcano in Costa Rica.

The previously undetected crater, which we named Crater 1, is located between the twin volcanic system Arenal-Chato at 84°41'53"W and 10°27'42"N (Figure 1). It resulted from a phreatic explosion occurring probably during the 1968 explosive phase, in which three other well-known main craters (A, B, and C) were opened along a tracture on the western side of the Arenal Volcano. Crater I has formed at the physical discontimuity that existed at the boundary of Archal's

lava-armor that was created during the 1500 cruption cycle. The explosion a state directed blast oriented 115° from the took orginated at a depth of approximately \$60 leaving a circular crater 25 m wide and 10 deep with an axis sloping 15° from them cal. The crater is made up of nonjuscuk Liva blocks and Lapilli and is now covered. thick terns.

Crater I substantiates the existence of a deep, SE-NW-trending fracture system to which the twin volcanoes have croked at gives important parameters in locating the zones of weakness in which future explore activity may take place.

This news item was contributed by Andrea? gia. Centro de Investigaciones Geofisica, Una dud de Costa Rica, Ciudad Universtaria Ro Facto," Costa Rica, and Clark Poore ACM? gram, Department of Geology, Beloit Colleg. b. loit, WI 53511.

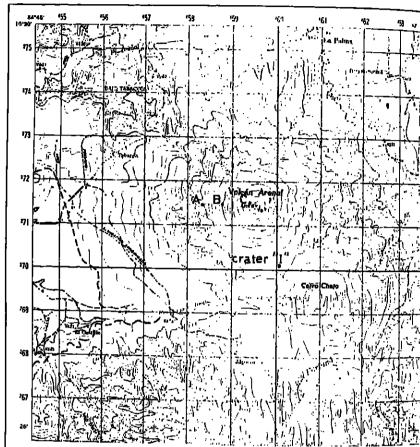


Fig. 1. Topographic map of Arenal-Chato twin volcanic system showing the localistic Crater I. Craters A, B, and C, formed during 1968 explosive phase, are also shown Map from the Instituto Geografico Nacional, San José, Costa Rica, Scale 1:50,000.

Irvine Receives VGP Award



T. N. Irvine

Textbooks of not so long ago typically presented the study of stratiform igneous intrusions as a simple and straightforward exercise in nature's petrology laboratory. The fractional crystallization products of mafic magma were presumed to accumulate sequentially, largely in response to gravity. Those familiar with the literature of the past several years are aware, however, that the textbooks of the next generation will conclude that this model, if not actually wrong, is at best a gross oversimplification. Why this apparent fall from grace of such a seemingly useful con-

One reason is that the number of geologists willing and able to visit the cold and lonely places where such bodies in the northern temisphere invariably occur has grown. Consequently, the amount of geological informa-tion on the structure and composition of such bodies also has grown. But merely increasing the size of a cottage industry need not necessarily alter the nature of its product. So too the new directions in the study of layered intrusions are the result of far more than just a

growth in the amount of available data It are primarily the result of a few creative po ple seizing new observations, combining with theory and experiment, and offering new insights into the meaning of these obe

The recipient of the 1982 VGP Award I N. Levine, is a prominent example of sub-person, and he is specifically honored for la studies of the Muskox Intrusion in norther ern Canada. An appreciation of the work has done there and the insights recovered from his studies may be gotten from his pl per in the volume on Physics of Magmatic cesses (R. B. Hargraves, Ed., Princeton Un Press, 1980). But any one of a number of b carlier papers on geological observations. ory, and laboratory experiments relating to the evolution of layered intrusions would be be illuminating in this regard. It is difficult avoid the suspicion that Irvine has a sent phone booth into which he steps to shed be mild-mannered exterior before writing papers of such intellectual force. So what has Irvine done to clear our visit

with regard to the meaning of layered in the sions? In general terms he has provided po suasive evidence that much more than a in the Muskox and other intrusions. portance of repeated injections of magna into a fractionating chamber, the medical of country rock, the mixing of fresh fraction ated, and contaminated magnes, the pendition of intercumulus liquids, the action of turbidity currents, and the operation of dor ble-diffusive convection have all been 120% nized through Irvine's careful work Al though, as a consequence, layered introdes can no longer be viewed as the result of six ple crystal fractionation and settling, they have actually become much more interesting petrological absorptions. petrological showcases for a rich variety of neous processes. For Neil Irvine's contr tions to this important and fundamental. transformation in petrologic thinking last pleased to present him with the 1982 VGF

Acceptance

I am most pleased to be honored with the award and to know that my work on layer intrusions is appreciated to such an oxide This work has been going on now form

than 25 years, so I presume that a considerable cumulative effect is reflected here. Over such a long time, one benefits through associations with many people, and I will take this occasion to mention those who have helped

My list has a strong Canadian flavor, and it begins with Bruce Wilson at the University of ba, where I was an undergraduate. When I think back. I realize that my career was practically determined by two or three of his lectures in which he described some of his own very perceptive work on layered intrusions and their ore deposits. Those lectures attracted my interest to the rocks that have since become my principal research subjects. Bruce also directed me to Caltech, which was the next step on my way.

Shortly after I arrived at Caltech, I learned

hat Jim Noble, who was then Professor of mic Geology, had charge of a project in which he hired students to work on ultramafic rocks in southeastern Alaska. This appealed to the interest that Wilson had raised. when the time came to find a job for the following summer, I sought Jim out. He signed me up to go to Duke Island, where, a it turned out, we found the world's most beautifully layered ultramatic rocks. From that time on I was hooked! Most people who know southeastern Alaska shudder at all the rainy weather, and Duke Island itself is a rather swampy place. But to me at the time, was the most exciting place on earth: I literalh thrilled at the mapping that unravelled complicated layering structures, multiple inmisions, and magmatic replacement bodies. During this work and through to its publica-tion some years later, Jim Noble gave me patient support and encouragement, and I am greatly indebted to him.

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lover. A view of the 2.8-km-diameter Akutan Volcano caldera of Akutan Island Alentian Islands. Such a view, looking south on January 16, 1983, is rare owing to the normally poor Aleutian weather onditions. Note the recent ash fall on the now just to the left of the steaming, ciner-dominated cone. A small ash eruption ccurred from this cone in December 1982. In September 1978, a fairly large ash eruption occurred in which andesitic lavas flowed from the base of the steaming cone over a large part of the caldera floor, through the northern breach in the caldera wall, and then down the northern breach in the caldera wall, and then down the northern slope of the volcano to within 1 km of the coast. During recent investigations, organic soils were found directly beneath parts of the large pyroclastic flow and air-fall deposits that resulted from the calderaorming event. The carbon 14 age determined for this soil (three dates only) suggests that the Akutan caldera may have formed about 5,000 yr B.P. (Photo courtey of John W. Reeder, State of Alaska Division of Geological and Geophysical Surreys, Anchorage, AK 99510.)

Gerhard von Gruenewaldt, who arranged a stimulating 3-month visit for me to the Bush veld Complex; and last but not least, my wife, Lorna, whose wisdom and spirit have been major factors in my career and who, together with our children, Michael and Kerri, gives ence in itself, in part because the country was

my life its balance. I have had many pleasures in working with layered intrusions, but I will admit also to the feeling that with all my opportunities I should have accomplished more. This award is very much a reminder in that respect as well, but if it helps to keep me going (as it should), then it will be all the more to my good. Thank you very much.

Meetings

After graduation I worked for a summer

with the Geological Survey of Canada on a

helicopter survey in the Northwest Terri-

mapped an area of approximately 60,000

virtually unknown and in part because I

square miles. This was a marvelous experi-

made a transition from mapping at 50 feet to the inch at some places on Duke Island to

mapping at 8 miles to the inch from a heli-

copter. There is nothing quite like that to

significance of the survey, however, is that

the area included a large, layered intrusion

is now called the Muskox Intrusion. I saw

impressed that it was totally different from

triguing. I was delighted, therefore, several

When I joined the Muskox project at the Geological Survey in Ottawa, Charlie Smith

was leader, and Chris Findlay, though still a

student, was deeply involved. Charlie had

produced a map of the intrusion that ranks

with the best of its kind, and he and Chris

were prime forces in promoting and carrying

out a major drilling program to obtain con-

others who contributed, have long ago gone

on to other endeavors. I am very much their

beneficiary, and whatever success I have had

with Muskox is largely owing to their excel-

tory, I have continued to work on Muskox,

but my director, Flatten Yoder, has made it

possible for me to also explore many other

bia; Skaergaard in Greenland; Stillwater in Montana; and Bushveld in South Africa; I

have visited Rhum in Scotland and the Du-

water have been receiving most of my atten-

tion. At Skaergaard, I've gone back to de-

tailed mapping to document lavering struc-

scenery and exciting trips. My thanks here go

to Alexander McBirney. Mac encouraged me-

more than anyone he opened my eyes to the

potential importance of double-diffusive con-

vection as an igneous process. At Stillwater

the feature of interest has been a platinum-

palladium ore zone. This study, which has led

deeply into double-diffusive convection and

magma mixing, has been done in collabora-

grateful to them and their employers for the

Dick Jahns, who taught me useful mapping

methods; Gerry Wasserburg and Sam Ép-

plying physics and chemistry to geological

To round out my list, I would also mention

stein, who impressed me with the value of ap-

oblems, Hugh Taylor, with whom I have

sions; Hu Gabrielse, who gave me much help

in work that I have done in British Columbia;

had countless discussions of layered intru-

tion with three geologists with the Johns-

Manville Corporation—Stan Todd, Dong Keith, and Don Schissel—and I am most

to go to Greenland in the first place, and

tures and I have enjoyed the splendid

ntrusions, I have been back to Duke Island;

Since I moved to the Geophysical Labora-

lent groundwork.

tinuous samples. Charlie, Chris, and many

years later when the opportunity came for me to work on it full time.

the Duke Island rocks, yet every bit as in-

broaden one's horizonal The more immediate

that had only just been discovered. That body

Muskox only briefly that summer, but I was

tories. On that survey we geologically

El Chichón Data

The March-April 1982 eruptions of El Chichon have produced the largest atmospheric impact of any eruption since at least Krakatau in 1883. The main geological variable that is responsible is the abnormally high S content of the crupted magma. The ultimate souce of this sulfur is still unresolved.

Some highlights of the scientific papers dealing with the cruptions and presented at the AGU Fall Meeting in San Francisco, December 10-11, are discussed below. (The abstructs are in Eos, November 9, 1982, pp 897-98, 900–902, and 1126–1127.)

Wendell Duffield et al. described the geologic setting. Although scanty information is available, El Chichón was an inconspicuous. dome-capped stratovolcano with active surface geothermal activity before the eruption. I have worked on Axelgold in British Colum-At least two prehistoric cruptions occurred in the last 1250 years. The volcano is built on volcanic and sedimentary rocks of Terriary age which overlie Cretaceous sediments. A drill hole near the volcano into the Cretabith Complex in Minnesota. The opportunity to compare all these bodies has been wonderceous section has penetrated evaporite beds. ful, all the more so because of Hat's enthusi-Dulheld et al. suggested that these rocks may have influenced the magmatic volatile truc-In the past few years, Skaerwaard and Stilltion of the 1982 magma.

Servando de la Cruz described ground ob servations of the eruption. The 1982 activity consisted of three main eruptions: March 28 at 2332 (local time). April 3 at 1935, and April I at 0533. The first exuption destroyed part of the summit dome, produced an emption column 17 km high, lasted about 5 h. and caused a widespread ash fall over southern Mexico, Belize, and northern Guatemala.

The second phase of the cruption was documented in a speciacular sequence of night-time photographs which show the growth of the incandescent eruption column and volcanic lightning. A pyroclastic surge occurred in the first 10 minutes of this eruption. Cruz's pictures show the collapse of the eruption column and the movement of a pyroclastic flow down one of the river valleys to San Francisco Leon. The flow front, brightly incandescent and apparently turbulent, was ob-

vious in the photographs.

The third eruption produced an airfall de-posit only, from a similar magnitude eruption column. The three eruptions were similar in the volume of material erupted. Various speakers estimated the total volume erupted at 0.4-0.6km3 of dense rock.

As a result of the eruptions, there is now a

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crater occupying the site of the old dome, pytoclastic surge (or low aspect-ratio ignimbrite) deposits all around the crater, and pyroclastic flow deposits down river channels for several kilometers. These disrupted drainages and caused many secondary lahars.

A network of seismographs was operating in a six-station telemetered array for 2 years prior to the 1982 eruption. The data, studied retrospectively due to the remoteness of the stations, and reported by S. K. Single et al., show a seismic build-up which began weeks before the cruption, and increased sharply on March 1. The high seismicity losted through March 28 but stopped completely 2 h before the first eruption. The depths of one type of earthquake, thought to be associated with the magma-groundwater contact, was about 5 km. There were also a significant number of quakes at 15–20 km depth. This suggested to de la Cruz that there may be a dual magma

storage system. Varekamp and J. Lulu in separate pa pers reported on the extent, petrology, chemisny, and mineralogy of the ash. The ash is -grained (85% <1 mm), highly dispersed. and has the characteristics of a plinian tranmional to phrearoplinian fall deposit with three fall units, assumed to correlate with the three emptions. The ash fell out of the atmosphere partly as aggregates, which Varekump proposed were held together with sulturic acid. The magma was an alkali-rich trachyandesite with 56% SiO2, 2.8% KgO and an extremely high S content (0.5-1.0% S). This S concentration is more than 10 times that "expected" for a magma with the composition of El Chichon's. It is also about 50–100 times greater than the 1980 Mount St. Helens dacite. Andesite, hormblende, augite, magnetite. sphene, and apatite are phenocryst minerals,

but compelling evidence was given by Luhr to

(cont. on p. 452)

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show that 1% volume anhydrite microphenocrysts observed in these rocks was also in equilibrium with the magma.

Initial isotopic data on S and O in the anhydrite obtained by R. Rye suggest that the evaporites below the volcano were not the source of the anhydrite. Lahr estimates the magma temperature was about 800°C before eruption and that it contained 4-5% HgO and 2.5% S.

J. Hoffer presented data showing chemical composition of the fallout varied with distance from the volcano in a manner consist-

ent with atmospehric fractionation. S. Self emphasized the point that explosivity of an eruption is a poor index of atmospheric impact, using examples from recent history. He suggested that modest-sized, expiosive andesitic eruptions, similar to the El Chichon event except in the extreme 8 content, might be the most important cause of stratospheric optical depth perturbations. If andesitic eruptions can be shown to be typically S rich, this conclusion would be strengthened.

The atmospheric scientists presented basic data on the stratospheric effects of the eruption. There were many measurements documenting a 25-33% decrease in solar radiation at the earth's surface due to the El Chichon stratospheric particles. The Manna Los Observatory group reports that this is the largest decrease in atmospheric transmission in the 24-year record there.

A. E. Strong (NOAA-NESS) showed that sea surface temperatures over a broad area of the equatorial Pacific were rising at an abnormal rate since the eruptions. The effects on North American weather may be to alter the storm tracks and result in an unusual, but not necessarily colder, winter in North America. A. J. Krueger (NASA-GSFC) showed that SO2 from El Chichon in the stratosphere caused a spectral interference with the Nimbus 7 Total Ozone Mapping Spectrometer (TOMS). The interference wiped out the ozone experiment, but allowed the total mass of SO2 released to the stratosphere to be estimated at 3.3 x 10°T. This is 10-15 times the mass estimated by different methods for Mount St. Helens.

This meeting report was contributed by W. 1. Rose, Department of Grology, Michigan Techno-logical University, Houghton, MI 19931.

Opinion

The second of the

1.

Forecasts and **Predictions**

In recent volcanologic literature, the terms forecast and prediction have generally been considered synonyms. Wadge and Guest [1981], however, in assessing the possibility that Mount Eina would erupt before May 1982, stated that "these are not predictions of specific events but general forecasts . . . based on the behavior of the volcano during the past seven years." Lockwood et al. [1976] used the term forecast in anticipating an eruption of Mauna Loa before the summer of 1978 on the basis of historical records. In contrast, Wood and Whitford-Stark [1982] used the terms forecast and prediction synonymously when they anticipated an eruption of Kraffa before the end of May 1982 by projecting records from 1975 to the end of 1981; in terms defined here, this statement was a forecast. The fact that all three of these forecasts proved incorrect indicates the relative uncertainty of simply projecting past records and it suggests the desirability of distinguishing, whenever possible, such general statements from more specific predictions based on repeated measurements of changing phenomena on a short time scale.

Three types of written public statements about volcanic activity at Mount St. Helens are issued by scientists at the Cuscades Volcano Observatory of the U.S. Geological Survey and at the Geophysics Program of the University of Washington:

 Å "factual statement" describes current conditions but does not anticipate future events; such statements are revised when warranted to keep the public and government informed of new developments.

 A "forecast" is a comparatively nonspecific statement about activity expected to occur weeks to decades in advance, issued commonly without data from repeated monitoring, and based on a projection of geologic, geophysical, or geochemical records. Another kind of forecast uses monitoring data whose implications are not well understood. Forecasts aid particularly in land use planning and in the development of emergency response plans.

 A "prediction" is a comparatively specific statement giving place, time, nature, andideally—size of an impending eruption. The likelihood of an eruption should also be stated, but such a statement is difficult to quanti-

Predictions are generally based on measurements of relatively short-term chages in longstanding patterns of activity. Predictions may evolve from forecasts and should become increasingly more specific as the erup-tion nears. At Mount St. Helens, a prediction

is issued a few hours to a few weeks before an eruption—any time there is a relatively clear view of future activity as judged from current similarities with past precutsory pat terns and from interpretations of the active volcanic processes. Predictions reduce risk to life and property and provide a public test of

scientific hypotheses about volcanic processes. Stratigraphic studies led to a 1975 forecast of renewed activity at Mount St. Helens "perhaps before the end of this century" [Crandell et al., 1975]. On the basis of seismic, geodetic, and geologic data, forecasts for an eruption and landslide(s) in the near future were issued in March and April 1980 before the catastrophic eruption on May 18, 1980. Forecasts in March and August 1981 anticipated dominantly nonexplosive behavior over the next months unless some reversal in geophysical or geochemical indicators occurred; these forecasts remain in effect.

Correct predictions were made of all 13 eruptions at Mount St. Helens from June 1980 to the end of 1982 on the basis of integrated geophysical, geochemical, and geologic monitoring. Predictions several days to 3 weeks before eruptions were based largely on patterns and rates of ground deformation of the crater floor and lava dome: predictions within about 3 days of eruptions depended chiefly on rates of cumulative seismic-energy release and increased numbers of shallow. volcanic earthquakes. Predictions in February and March 1983 were not as successful, owing in large part to poor weather, which curtailed most monitoring, and perhaps to subtle changes in behavior of the volcano.

Subdividing the broad category of anticipatory statements into relatively nonspecific forecasts and relatively specific predictions may have general applicability in volcanology. Volcanologists commonly are called upon to make statements about the future that are based either on projections of past geologic or geophysical records or on insufficient or poorly understood data. Such statements can profitably be distinguished from those based on adequate, up-to-date data on changing conditions at a volcano; such a distinction is scientifically honest and can help public authorities in their evaluation of the statement. There will always be gray areas; in such instances, forecasts rather than predictions should probably be made. In many cases, lowever, the distinctions are relatively well lefined, and the procedure used at Mount St. Helens can be considered.

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Donald A. Swanson David A. Johnston Cascades Volcano Observatory U.S. Geological Survey Vancouver, WA 98661

Krafla Revisited

"Predictions" of imminent volcanic eruptions are more successful than are "forecasts" of impending activity if we use the terminology defined by Swanson in the accompanying article. The implication is that, despite occasional intervals of periodically recurring eruptions, the long term (months to years) activity of volcanoes is stochastic. Once magma rises near the surface, however, and initiates measurable phenomena (harmonic tremor, inflation, increased furning, etc.), a volcano appears to be locked into a nonreversible process leading to an eruption weeks to hours hence. Each type of forewarning is valuable, and USGS volcanologists have demonstrated that the basic monitoring and prediction tech-niques tleveloped for effusive eruptions in ie to explosive activity in the Cascades. But longer term forecasts, as pointed out by Swanson, are still largely un-

Nonetheless, we believe that forecasts should continue to be made and published for two reasons. First, the forecasts may be correct, providing a longer time for planning nitoring activities, evacuation plans, etc. Responsible forecasts also serve to increase awareness of volcanic hazards among local authorities, so that when eruptions do come, there has been at least psychological warning. Second, a forecast is based upon observed patterns of activity of a volcano and thus is also an attempt to describe and understand eruption processes. Faulty forecasts have one advantage over erroneous predictions; The former do not have the immediate social and political consequences of the latter (see Bosock, 1978, and numerous replies).

Our forecast of an eruption at Kraffa caldera before the end of May 1982 was wrong. There has not been any eruptive activity since November 1981 and continued monitorir by Icelandic scientists reveals no evidence for an impending eruption. We could attempt to neutralize our forecast failure by any or all of the following arguments:

(1) Kralla failed to maintain its previous 6year pattern of activity.

(2) Inflation shifted to new areas immediately prior to our analysis, perhaps altering magma supply processes and rates.

(3) Volcanoes do not empt forever; it had to stop some time. All of the above are true; we did not make a mistake in our analysis or forecast-we simply had the bad luck to discover an emptive pattern one cruption too late. Because the eruptive pattern has failed there are now no hints for forecasting possible future activity at

Kraffa, but monitoring will provide data for

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Books

future predictions.

Cooke-Ravian Volume of Managing the Ocean Volcanological Papers

Geological Survey of Papua New Guinea Memoir 10, R. W. Johnson (Ed.), Geological Survey of Papua New Guinea, Port Moresby, 265 pp.

Reviewed by Chris Newhall

A splendid volume entitled Volcanism is Australasia and edited by R. W. Johnson (Elsevier, New York, 1976) introduced many readers to volcanoes of Papua New Guinea. Now, Johnson and the Geological Survey of Papua New Guinea have published an equally splendid sequel that is a tribute to volcanologists Rob Cooke and Elias Ravian, killed during the 1979 eruption of Karkar Volcano, From Bam and Blup Blup to Bagana and beyond, 25 papers in the new work cover a wide vari ety of topics-including reconnaissance mapping and stratigraphic studies, interpretation legends and old historical records, detailed studies of Karkar lavas and Rabaul pyroclastic deposits, and documentation of the precursors and characteristics of some recent cruptions. A wide variety of volcanoes is also covcred, from small stratovolcanoes and domes to large calderas.

Researchers of Papua New Guinean volcanism have used an innovative and pragmatic combination of historical records, geomorphologic and geologic information, and in re-cent years petrological and geophysical data to learn a great deal about their subjects. This book captures the full scope of these studies and in so doing tells us not only about specific volcanoes but also how to study them in spite of limited resources, difficult logistics, discontinuous exposures from island to island, dense tropical vegetation, and deep

In several respects the Cooke-Ravian Volume complements Volcanism in Australasia and should be read with the latter in hand. Many papers in the later book assume familiarity with topics covered in the earlier one, e.g., tectonic and petrologic studies in Papua New Guinea. Together, these two volumes are a major step toward an updated version of the Catalogue of Active Volcanoes for Alclanesia (IAVCEJ, Naples, 1957) and a comparison with the Catalogue shows that much has been learned over the intervening years.

A strong descriptive thread runs through the volume. This thread is both its fundamental strength and an appropriate reflec-tion of the groundwork that needs to be done before one can get on to more interpretive studies. Descriptions of eruption precursors and characteristics are excellent. I must admit to wishing that some descriptions of older py-roclastic sequences or morphologic forms had been carried through to more interpretive overviews, but these gaps between description and interpretation can be a challenge to future workers. Several papers do go beyond description and are important contributions to an understanding of volcanic processes. A paper by McKee et al. on hydroeruptions at Karkar is an especially thorough and interesting examination of the mechanism of hydroor phreatic eruptions, the very hazard that

claimed the lives of Rob Cooke and Elias Ra-The volume is printed on high-quality paper stock and is clothbound. Its photographs are at once a strength and a weakness; their number and selection are excellent, but the quality of their reproduction is mixed, with many photographs blurred by poor printing. Perhaps in a second printing this fault could be corrected. Overall, the book is an excellent

value at approximately \$30 (22 Kina). The volume contains a glossary and abstracts in Tok Pisin (Papua New Guinea Pidgin) in an attempt to attract a wider Melanein audience. At the very least this is symbolically important, and 1 hope that this wider audience is reached. Volcanologic studies are of interest not only to the international and the growing Papua New Guinean scientific munities, but are also of vital importance to the many people who live on or near Pa-pua New Guinea's active volcanoes.

Chris Newhall is with the David A. Johnston Cascades Volcano Observatory, U.S. Geological Survey, Vancouver, WA 98661

Resources of the United States: The Role of the Federal Marine Sanctuaries Program

D. P. Finn, Lecture Notes in Constal and Enrine Stud., vol. 2, Springer-Verlag, New Yol. ix + 192 pp., 1982, \$16.

Reviewed by Giulio Pontecorvo

In 1969, the Straton Commission report provided a plan for the systematic develop ment of a national policy on marine allain In subsequent years no such systematicap proach to a coherent marine policy was dertaken. The de facto policy approach of the 1970s was a plethora of individual legitive acts which provided specific de jure rules, but which left administrators the on plex problems of working out the adminis tion of areas of overlapping authority, with conflicting or inconsistent goals and jurish tion. The major acts of the 1970s, the Fale Conservation and Management Act of 1956 Mammals and Non-Migratory Birds—The Marine Mammal Protection Act of 1972; Coastal Zone Management Act of 1972; is dangered Species Act of 1973; Marine Potection, Research, and Sanctuaries Act of 1972; and others, are clear indications of a national commitment to regulation of the markets for the output from the ocean sear But while the need for intervention in makets was clear to legislators, the failure total ploy a systematic approach and provide guidelines adequate to permit the rationalize tion of complex problems doomed the pe meal approach to ocean policy to estrincreasing administrative problems and ulti-

mately to ineffective government program.
In his monograph, Managing the Octan Resources in the United States, Daniel P. Fine by carefully documented certain of these legal and administrative issues that have arken and around one of these pieces of legislate of the 1970s, the Marine Sanctuaries Program. The monograph sures by developing three case studies: (1) the oil and gas least on Georges Bank which focuses on confiding statutory issues, (2) the Santa Barbara Channel problem of overlapping regulator authority, and (3) the resources of the case. continental shelf where there are gaps in the

statutory authority. In turn, these case studies provide the base for examination of a set of specific quesions.
"Cam federal agencies, administering district. regulatory and protective programs, form late coherent policies and consistent decision on marine resource development? Should specific provisions be made for special nat agement of marine areas with especially able resources or a high probability of some user or resource conflict? Are all valuable marine resources subject to legislative audit ity and can they be adequately protected through existing programs? How elident the federal management as which the federal management as well as which the federal management as which the federal management as well as well as well as which the federal management as well the federal management system in achieved balanced decisions?" (p. 3).

The case studies provide a c of the legal processes surrounding program implementation. With the case studies at 60 dence, the monograph then goes on to com ine, in three more chapters, the specific sues, coordination between agencies, the problem of definition of programs, many ment difficulties, the institutional perspent

of the managers, political pressures, etc.
This monograph is a valuable handhold. an important reference work, and also as sense, it is an object lesson in how not be

There is one serious omission in the special in general, to focus on legal and political sues is to leave out the underlying rathers for necessary and the serious ser for action. The concept of a sanctiary for requires an adequate structure of blooms and economic analysis to justify its existent and economic analysis to justify its existence and economic analysis and economic analy and economic analysis to justify its can to defend it against alternative uses and a give it a set of objectives that can guide me

agement actions.
Finn has provided an important serves describing how the system worked. We need better understanding of its railmain need better understanding of its railmain.

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Professor of Meteorolgy/University of Maryland.

The Department of Meteorology at the University of Maryland, College Park, invites applications for a leave line Professorahlp. We seek a well-established, highly recommended scientist with an outstanding international reputation in stmospheric and oceanic modeling and applications. We propose the establishment of a center to study the interactions of atmosphere, ocean and land processes and their impact on climate variability, and in particular to study the feasibility of short term climate predictions. The applicant should be qualified to head asch a Center, plan its projects, organize its activities, and bring to the University the necessary resources to attract outstanding scientists to the Center and to carry out its research functions. Salary is agoitable. To apply, please send a complocte vitae and the name of references to the Chairman. Search Committee, Department of Meteorology, University of Maryland, College Park, MD 20742. Applications received by 22 july 1983 will receive foul of the property of Maryland subscribes to policy of equal educations.

the University of Maryland subscribes to policy of the deducational and employment opportunity. In the University of Maryland is required by Title IX of the Education Amendment of 1972 not to discriminate and the Maryland is required by Title IX. riminate on the basis of sex in admission, treatment of students or employment.

Physical Oceanography/University of Rhode Island. A postdoctoral research associate position is available starting October 1, 1983 for studies of tropical processes in the Pacific. The research invokes the collection and analysis of data relating to the dynamic topography and zonal pressure gradients of the equatorial current systems as part of a Submit resume and professional references by August 15, 1983 to: Dr. D. Randolph Waus, Marine Riddle 15, 1983 to: Dr. D. Randolph Waus, Marine Riddle 15, 1983 to: Dr. D. Randolph Waus, Marine Riddle 15, 1983 to: Dr. D. Randolph Waus, Marine Riddle 15, 1983 to: Dr. D. Randolph Waus, Marine Riddle 15, 1983 to: Dr. D. Randolph Waus, Marine Riddle 15, 1983 to: Dr. D. Randolph Waus, Marine Riddle 15, 1983 to: Dr. Dr. Sotton, UNIVERSITY OF Riddle 2881. filand 02881.

An affirmative action/equal opportunity employer

Research Assistant in Ice Core Analysis/Ohio State University Applications are invited for a position at the Institute of Polar Studies, The Ohio State University, beginning October 1, 1983. Primary dutes of the position will include operation and maintenance of the Coulter counters in the class 100 clean room, and processing lee and firm samples. Misimum qualifications are BS degree in physical science or engineering and suitable laboratory experience (or equivalent experience). Please send applications, deadine 1 September 1988, to Director, Institute of Polar Studies, Ohio State University, Combusty, Ohio State University, Combusty, Ohio State University is an equal opportunity/affirmative action employer.

Postdoctoral Position in Hydrologic Modeling/
University of Arizona. A postdoctoral appointment in the area of modeling and calibration of hydrologic rainfall-rumoff models will be available beginning September. 1983 in the Department of Hydrology and Water Resources. University of
Arizona, Tucson, AZ. The initial appointment will
be for one year. The salary will be \$20,000-23,000
per year, depending on experience. The primary
source of funds is a grant by NSF for the improvement of the reliability of compartmental models.

QUALIFICATIONS: The successful applicant
must have received the Ph.d. degree in Hydrology
and/or Systems Engineering or a closely related
field by the starting date. Preference will be given to
applicants with expertise in the field of mathemattion theory.

tion theory.

TO APPLY: Send a complete resume and the names of three references to: Professor Soroosh Sorooshian, Associate Professor, Department of Hydrology and Water Resources, University of Arizona, Tucson, A7, 85721. Telephone: (602) 621-3131.

The University of Arizona is an equal opportunity/affirmative action employer.

Research Scientist for International Ground Water Modeling Center. A position is immediately available for a Research Scientist in the International Ground Water Modeling Center. IGWMC is an international information center for ground water modeling. It organizes an annual series of short courses, provides assistance in workshops and seminars, operates a clearinghouse for ground water models, conducts a program in applied research on ground water modeling, and publishes the Ground Water Modeling Newsleuter.

The successful applicant will have a Ph.D. in Civil Engineering/Hydrology with a background in quantitative ground water hydrology, including chemistry of ground water hydrology, including a least least one (1) year experience in modeling flow and transport processes and should be acquainted with related recent research. A solid background in numerical and stochastic analysis is required.

Incumbent will perform the applied research program of the Center, including exploring modeling needs and research from the applied research program of the Center, including exploring modeling needs and research from the applied research program of the Center's model information system MARS, in conducting the training programs, and in landling information request.

The annualized salary for the position is \$28,000 for a \$7.5 work week, typically thom 8:30 a.m. to 5:00 p.m. Interested applicants must include ID number

5:00 p.m.
Interested applicants must include ID number 042860 and social security number in a response by

July 28, 1983 to: Indiana State Employment Service 10 North Setiate Avenue Indianapolis, Indiana 46204 ATTN: W.F. Shepherd An Equal Opportunity Employer

Postdoctoral Position/Naval Postgraduate School. The Ocean Turbulence Laboratory has available The Ocean Turbuleuce Laboratory has available a postdoctoral position for a person interested in the analysis and interpretation of oceanic turbulence data. The tenure is for one to two years. The successful candidate should have a Ph.D. in physical oceanography and although experience with turbulence data is preferable it is not essential. The opportunity for involvement in data gathering expeditions is also available.

Remunes can be sent to the R.C. Lunck Content.

Resumes can be sent to Dr. R.G. Lueck, Code 68Ly, Naval Postgraduate School, Montetey, CA

An Equal Opportunity/Afternative Action Em-

Postdoctoral Position in Aimospheric Chemistry and/or Cloud Physics/Georgia Institute of Technology. Recent Ph.D. scientists interested in the development of theoretical models to study the chemistry and physics of precipitation are invited to apply to the Georgia Institute of Technology.

The salary is \$18,000/year; period of appointment is one-two years. Applicants should send vita and statement of research interests and the names of two references to: Professor W.L. Chameides, School of Geophysical Sciences, Georgia Institute of Technology, Atlanta, GA 3032.

GEORGIA INSTITUTE OF TECHNOLOGY IS AN EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER.

Geophysicisi/University of Saskatchewan. Subject to linal budgetary approval, the Department of Geological Sciences will have a new tenurable position in geophysics available July 1, 1984. Applicants should hold, or be about to receive, the Ph.D. or equivalent degree. They will be expected to teach undergraduate and graduate courses in geophysics and to build and maintain a vigorous research program. Excellent research opportunities exist in crustal and exploration seismtology and in all fields of mining geophysics. The department, to occupy a new building in 1985, already has well-equipped geophysical and dats-processing facilities. Applicants should send a letter outlining their teaching and research goals, accompanied by a full curriculum vitae including the names of at least three referees, to Dr. W. G. E. Caldwell, Head, Department of Geological Sciences, University of Saskatchewan, Saskatoon, Canada S7N 0W0.

Research Scientist/Space Plasma Physics, University of Iowa. A research position is available in the Department of Physics and Astronomy. The University of Iowa, for theoretical and interpretative studies of waves in space plasmas. Specific emphasis is on theoretical investigations of wave-particle interactions in planetary magnetospheres and in the solar wind. These investigations are to support the interpretation of data being obtained from spacecraft projects such as Dynamics Explorer. International Sun Earth Explorer and Voyager. The applicant must have a Ph.D. with good qualifications in plasma physics theory and shoud have some experience in the interpretation of space plasma physics data. Send a resume and the pames of three references familiar with the applicant's work to: D.A. Gurnett, Department of Physics and Astronomy, The University of Iowa, Iowa City, Iowa 52242, telephone 319-353-3527. The University of Iowa is an affirmative action/

Seismologist. The institute for Petrokeum Research and Geophysics in Holon, Israel, is seeking a seismologist to work on problems of earthquake risk assessment. Employment is for a period of one year with possible extension. Experience in statistical evaluation of earthquake risk is preferable but not mandatory. The Institute is a government owned company located in a suburb of Tel Aviv. It is responsible for most of the geophysical work in israel and it has an active seismological program including countywide and local telemetered seismic networks. Benefits include relocation expenses, housing allowance and a car. For details contact Dr. A. Institute for Petroleum Research and Geophysics, P.O. Box 1717, Holon 58117, Israel, telephone 08–805112.

ersity of Colorado, Boulder, Geochemist Posi-Geochemist with active research programs.

don. Geochemist with active research program, stable isotopes, radioactive isotopes, and/or trace elements is being sought for a joint appointment in the Department of Geological Sciences and the Cooperative Institute for Research in Environmental Sciences (CIRES) of the University of Colorado.

The one-half time position within the Department of Geological Sciences is tenure track at the assistant or associate professor level with a starting salary of \$12,000—\$15,000 for the academic year.

Teaching load will be half that of Itill-time faculty. The position within CIRES will be as a Fellow with appropriate office and laboratory space. One-half scademic year salary will be guaranteed by CIRES for two years at the departmental rate, after which incumbent must generate his/her CIRES salary from external sources. Incumbent may augment salary further by generating three months of summer salary from contracts and grants, and consulting.

mer salary from contracts and grants, and consulting.

Applicants with experience, publications, and/or movable existing research equipment preferred.

Preferred starting date would be January 1, 1984.
Closing date for applications is October 1, 1983.

Applications should include statement of research and teaching interests, experience, a full vitae, and four letters of reference.

Apply to: Professor Charles Stern, Chairman, Geochemist Search Conmittee, Department of Geological Sciences, Campus Box 250, University of Colorado, Boulder, CO 80309,

The University of Colorado is an equal opportunity/affirmative action, Section 504 employer.

Université du Québec, Rimouski/Faculty Position in Geological Oceanography. The Université du Québec à Rimouski seeks qualified persons to ful the following position: Full-time professor of geo-

the following position: Full-time professor of geo-logical oceanography.

FUNCTIONS: The successful candidate will be required to teach courses at the undergraduate and graduate levels and to develop new courses in sub-jects such as mineralogy, stratignaphy and micropa-leontology, and will be expected to collaborate with existing research programs in the fields of boothin-boundary layer, langeochemistry and coastal sedi-ment dynamics.

REQUIREMENTS: The successful candidate

REQUIREMENTS: The successful candidate must possess the doctorate in geological accanography or marine geology with specialization in mineralogy and/or micropaleontology, and direction research involving Quaternary marine deposits. Courses are given in French.

All applications will be treated confidentially, (Canadian law requires that Canadian chizens or landed immigrants be given preference). Interested persons should send their curricultum vivae before August 15, 1983 to: gust 15, 1983 to: Directeur

Département d'océanographie Université du Québec a Rimonski 300, avenue des Ursulines Rimonski, QC G51, 3A1.

Research Scientist II. The Solar Terrestrial The-Research Scientist II. The Sodal Terrestrial The ory Group at the University of New Hampshire seeks applications for a research scientist II to un-dertake a variety of theoretical problems on plasmand MHD processes in the solar atmosphere and the solar wind, and related energetic particle pile-

nomena.
Minimum qualifications: Applicant must possess a Minimum qualifications: Applicant must possess a Ph 11 or operation professional degree, with research leading to doctorate, with training in theoretical space plasma physics or a related field, (e.g., theoretical plasma fusion research), or masters degree and at least three years of research experience which is closely related to project work. Salary range \$20,110 to \$31,200; normally starting salary not to exceed \$22,510. Resume and three letters of reference should be sent before August 15, 1983, to: Dr. exceed \$22,310. Action and the series should be sent before August 15, 1983, to: Dr. J. V. Hollweg, Department of Physics, University of New Hampshire, Durham, NH 03824.

Iowa State University of Science and Technology, Department of Earth Sciences/Research Associates Electron Microprobe. The Department of Earth Sciences Invites applications for a Research Associate position as an electron microprobe specialist. The appointment will be a fully funded, permanent, twelve-month position. Salary will be cummensurate with swelfscentons.

The appointment will be a fully funder, perhalications. Primary duties are the operation and maintenance of a fully automated microprobe with WDS and EDS capabilities and the supervision of associated laboratory facilities. Additional duties include the instruction of research personnel in instrument operation. Ample opportunities exist for conducting collaborative and independent research involving the microanalysis of geological materials.

Applicants should have a M.S. degree in a science or engineering field, or equivalent experience, and experience with electron beam instrumentation. Persons with a working knowledge of WDS and EDS spectrometers and the accompanying computer operations and experience analyzing geological samples will be preferred applicants.

Application deadline is July 31, 1983, faster applications will be accepted if the position is not filled. Applications should include a complete resume, a statement of background and interests, copies of publications and names of at least three references. Applications and names of at least three references. Applications should be sen to:

Bert E. Nordlie

Department of Earth Sciences

lowa State University 253 Science 1 Ames, Iowa 50011 Iowa State University is an equal opportunity/af-

firmative action employer. University of Arizona/Faculty Position. The Department of Hydrology and Water Resources invites applications for a faculty position in hydrology with a specialty in ground-water chemistry. Candidates must have training and/or professional experience in hydrogeology and must have demonstrated abilities in the quantitative aspects of the topic. Appointties in the quantitative aspects of the topic. A pooinment will be at the level of an assistant or associate professor. Interested individuals should obtain further left and the contraction of the contra

ther information from:
Professor Stanley N. Davis
Chalrman, Search Committee
Department of Hydrology and Water Resources
University of Arizona
Tucson, Arizona 85721
602-621-5131

The University of Arizona is an affirmative ac-

CNOC Chair in Mapping, Charting and Geodesy (Hydrography)/Department of Oceanography, Naval Postgraduate School, Monterey, California.

Under the sponsorship of the Commander, Naval Oceanography Command (CNOC), a Chair in Mapping, Gharling, and Geodesy (MC&C), with emphasis on Hydrography, has been established in the Department of Oceanography. Naval Postgraduate School (NPS). The objective of the Chair is to promote MC&C studies and research by students and facility, and to encourage acquaintance of the Chair faculty, and to encourage acquaintance of the Chair with Navy needs in the MC&G field.

"各种"的"多种"是主义和第二级等人和全国的

SENIOR HYDROLOGISTS

ARE YOU LOOKING FOR CHALLENGING **ASSIGNMENTS?** WE HAVE THEM IN:

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If you have an advanced degree, professional registration, computer-applications skills, and 5-15 years experience, you may qualify. You will lead and work in stimulating interdisciplinary teams on a virtually worldwide range of ground water and surface water hydrologic systems. Your willingness to travel overseas and your language capabilities are a plus.

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The incumbent's principal responsibilities will be to conduct research and to supervise student thesis research of a type that will interface the Hydrographic Sciences Program of NPS with the MC&C needs of the Navy. A favored theme is research applicable to operational hydrographic survey problems

Academic excellence and the ability to bring forth new ideas are the primary considerations in the selection process. The term of appointment will normally be for twelve month periods (1 October to 25 September); however, exceptions will be considered. Candidates may be members of the academic, federal, or private sectors. Where appropriate, Interagency Personnel Agreements are preferable. For further information, contact Professor C.N.K. Mouers, Chairman, Department of Oceanography, Naval Postgraduate School, Monterey, California 93940, telephone number (408) 646-2673. Send curriculum vitae/resume information and letters of interest to interest to the above address.

The Naval Postgraduate School is an Equal Opportunity/Affirmative Action Employer. Academic excellence and the ability to bring forth

Chairman—Department of Geological Sciences, Wright State University. The Department of Geological Sciences, invites applications for the position of chairman, to be appointed September 1984. We seek a dynamic individual with administrative talent and an appreciation for research and practice-related educational activities. Rank is at the full professor level and no restrictions have been placed on arsor level and no restrictions have been placed on ar-eas of specialization. The department is active with 12 faculty and an emphasis on professional practice, yet maintaining a firm commitment to basic re-

search.

Send a letter of application, curriculum vitae and names of three references to:

Chairman, Search Committee

Department of Geological Sciences

Wright State University

Dayton, OH 45425.

Weight State University and internative actions

equal opportunity employer. Closing date for the position is October 31, 1983.

ght State University is an

The University of Auckland, New Zealand. Post-doctoral fellowship available in the field of The Petrology and Tectonic Setting of Late Cenoroic Volcanic Activity in Northland, N.Z. Applicants should have a Ph.D. NZ\$ 1,805 per month plus return airfare. Enquirles to Dr. I.E.M. Snulls, Geology Department, University of Auckland, P.B., Auckland, New Zealand.

Seismologist, Geophysicist/Carnegic Institution of Washington. A post ductoral position has just become available at the Department of Terrestrial Magnetism for a seismologist/geophysicist with broad interests. Please mail resume and request three letters of reference to be sent to Geophysics Fellowhip Committee, Department of Terrestrial Magnetism, Carnegie Institution of Washington, 5241 Broad Branch Road NW, Washington, D.C. 20016.

Graduste Assistantiships/Howard University.

Howard University in Washington, D.C., offers a new graduate program for the M.S. degree in geoscience; made possible by a grant from the Gulf Oil Company. Areas of specialization are field geology/geophysics, geochemistry, and meteorology/hydrology with remote sensing. Some stipends and assistantiships are available. Potential students should write to Dr. Eric Christofferson, Department of Geology and Geography, Howard University, Washington, D.C. 20059.

<u>Meetinas</u>

Announcements Southwest Water

An interdisciplinary conference on meeting the current and anticipated water needs for farms, municipalities, and industries of the Southwest will be held in Dallas, Tex., on April 3-5, 1984. Focusing on the technical, economic, financial, and legal aspects of this problem, the conference will explore eight inajor topics: water needs and demands, water availability, competition for water resources, strategies for increasing the availability of water, demand reduction, water conservation, water reuse, and protection of ground and surface waters.

Entitled "Water for the 21st Century: Will It Be There?" the conference will be held at Southern Methodist University in cooperation with several professional organizations and various regional, state, and federal agencies.

Conference proceedings will be published.
Authors interested in presenting papers must submit one-page abstracts by August 30, 1988, to one of the separate coordinators appointed for the eight major topics of the conference. For more information contact the general chairman, Michael A. Collins, School of Engineering and Applied Science, Southern Methodist University, Dallas, TX 75275 (telephone: 214-692-3060).

Meeting Report Aeromagnetic Data Workshop

A workshop on aeromagnetic data, spon-sored by the National Geophysical Data Center (NGDC) of the National Oceanic and Atmospheric Administration, was held in Boulder, Colo., November 16-18, 1982, to evaluate the requirements for a national aeromagnetic database. The following recommendations were developed by J. R. Heintzler. Woods Hole Oceanographic Institution; W. J. Hinze, Purdue University: A. M. Hittelman, ARCO Exploration Company; K. Svendsen, CIRES, University of Colorado; D. M. Clark, National Geophysical Data Center; T. M. Auderson, Union Oil of California: and P. Ochsner and R. Van Nieuwenhuise, Cities

1. A national aeromagnetic anomaly data file of available digital data and a central distribution center are urgently needed in the United States.

in the second

Magnetic methods have a long and successful history of mapping earth's crust for both scientific and applied objectives. Probably no other geophysical data set provides as much information on as broad a range of geological problems, although it seldom provides a unique answer to any one problem. The mag-netic method is primarily directed toward mapping the crystalline basement and igneous intrusive and extrusive rocks. These rocks are largely unknown because they are hidden from direct geologic observations by a cover of younger sedimentary rock formations and because only limited deep drilling has been conducted in these areas.

Thus, the magnetic method is used to map the structure and petrologic variations within

the crystalline rocks and in so doing attacks a wide variety of problems dealing with the geologic and tectonic history of the crust. Magnetic data have traditionally played a major role in petroleum exploration. In recent years, magnetic data have been applied to a host of new problems such as geothermal exploration, seismic regionalization, site stabil-ity, waste disposal, and plate tectonic studies. Furthermore, the ability to accurately observe magnetic data from airborne platforms has permitted the acquisition of data over difficult-access terrain and the correlation of continental and marine geological patterns.

It is clear that the uses of magnetic anomaly data are broad and are expanding beyond he purpose for which they were acquired. In fact, we have now reached a point where data takers are no longer the principal users; often the nonspecialist, who has no direct access to the data except through repositories, is a principal user. These data users in particular are interested in multiple data files for correlation purposes. Multiple data files are most effectively handled by a central repository. In the past decade, vast areas of the United States have been acromagnetically surveyed at several different specifications by public agencies. Also, an increasing amount of anomaly data is available in digital format. It is important that these data be put in a repository before they are decimated, filtered, or altered in a fashion that loses information that may be useful to another user.

2. A standard data-exchange format is

The establishment of a common digital format is important because nonstandard formats hamper data archiving and exchange. A standard format will accelerate the transfer of data, set a standard for the documentation, facilitate comparisons with other geophysical data, establish data precision requirements of the scientific community, and reduce the data deterioration caused by reformatting errors.

for several reasons, the use of a format structure similar to that of the marine geophysical data-exchange format (known as MGD77) is desirable. The MGD77 format contains correlative data (marine magnetics, gravity, and bathymetry data collected at sea) and forms the foundation for the Geophysical Data System (GEODAS), developed by the National Geophysical Data Center, GEODAS performs a wide variety of file management functions (e.g., field validation checks) and supports an online inventory system producing such products as trackline plots and tabu-

Though most of the data may result from national programs, collection may not be limited to U.S. data. Ultimately, some non-U.S. data will be included, and this could become a World Data Center function. Because format and instructions for submission of data to the World Data Centers are formally given in the "ICSU Guide to International Data Exchange," we recommend that the ICSU panel on World Data Centers include the class of airborne data in its next edition of the guide. NGDC can help draft an appropriate section on airborne data.

We also recommend that the Society of Exploration Geophysicists (SEG) endorse the format. Consequently, SEG is being approached to sponsor this initiative and establish a working group to develop such a for-

AGU has arranged inexpensive group flights to the

18th General Assembly

of the

International Union of Geodesy

and Geophysics August 15-27, 1983

Hamburg, West Germany.

Departures have been booked on

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Supporting Members

The following individuals have been added to the list of Supporting Members. The full list was last published in the May 10, he survey area, are variable, and no compre-1983, Lm.

Life Supporting Members Athelstan Spilliaus

Individual Supporting Members Lloyd E. Brotzman William D. Crozier Sigmund I Hammer John C. Maxwell

plans to publish the proceedings of this sol shop that will include in-depth contribute of all speakers and many of the other auto

This meeting report was contributed by Davi M. Clark, National Geophysical Data Centu, et Allen M. Hittelman, ARCO Exploration Co.

Separates

3. A national magnetic anomaly survey

inventory is a necessary element in establish-

ing a national magnetic anomaly data base.

quired by the U.S. Geological Survey, U.S.

Navy, U.S. Department of Energy, academic

institutions, and various state agencies over a

35-year period. The specifications of data ac-

quisition and reduction, as well as the size of

hensive catalog or inventory of these surveys

4. An external advisory committee could

be of great value to NGDG and should be es-

NGDC, which has an excellent record of

against data centers a decade ago. They have

effectively used ad hoc groups and workshops to further their work. However, because of

the large amounts of aeromagnetic data that

should become available, a standing advisory

committee is recommended to ensure that the

data management efforts meet national re-

quirements and to aid in soliciting new data.

An external committee should be more effec-

tive than NGDC in acquiring data from in-

dustry, academia, and other government

The National Geophysical Data Center

serving the user community, has weathered

all the adverse criticisms that were leveled

and their specifications has been compiled.

Currently, most of the publicly available magnetic anomaly data and maps have been ac-

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Aeronomy

Odio (Absorption and scattering of radiation)

IMBLASTIC SCATTERING EFFECTS ON PROTOZLECTRON SPECTRA

AND LONGSFRENC LIECTRON TEPFEATURE

K. Stanges and M.H. Rame (Geophysical Institute,
University of Alaska, Pairbanks, Aleska, 99701)

Three sate of inelastic scattering cross sections
have been used by various investigators in energy
degradation computations of photoelectrons. The
effects of the three sets upon photoelectron spectra
in the ionosphere, electron heating rates and
temperature, and dayglow emissions are exceined for
solar sinfown and solar maximum conditions.
Comparison of individual cross sections shows large
differences amongst the three sets but the overall
inelastic scattering, Aumend over etates and specios
is sufficiently similar such that the offect on the
electron heating rate and temperature is only minor.
Photoelectron spectra differ in details at energise
below about 20 eV. The major difference is found in
the dayglow spectrue.

J. Geophys. Res., Blue, Feper 1A0906 J. Geophys. Res., Blue, Paper 1A0906

0450 Pressure, density and temperature LAWR THERMOSPHERIC STRUCTURE FROM MILLSTORE HILL INCHERENT SCATTER RADAR MEASUREMENTS. I. DAILY HEAN . B. Wand (Haystack Observatory, Westford, stte. 01856)

Gassachusetta, 01856)
Daystime temperature determinations from 151 days of incoherant scatter rader measurements at Milistons Hill (42.6 M) from 1970 to 1975 were analyzed to the control of the lower determination of the lower determinat (42.6° M) from 1970 to 1975 were analyzed to characterize the mann daily tomperature in the lower thermospheze (103-125 km). An analytical model fitted to the measured temperatures contained terms to apacify the dependencies of the mean daily temperature on dny of year (annual and semi-annual terms), solar cycle, solar rotation and geomagnetic activity. The model representation, whose coefficients are tabulated, showed that messonal, solar cycle, and geomagnetic effects were all of comparable magnitude and could each produce a variation of 3-10% in the mean temperature. The solar rotation effects were found to be small. The annual term and the amaliar semi-annual term combined to produce a Ausman or later summar temperature recombined to produce a Auman or later summer temperature maximum. Geomagnetic activity effects were determined on the basis of a delayed Ep index and a propagation delay of 3.7 hours was obtained from the model fit to the lower thermospheric temperature measurements. An increase in ather mean solar flux or Ep produced an increase in the mean daily temperature, the magnitude of the increase in the mean daily temperature, the magnitude of the increase in the mean that the larger at the highest altitudes. Comparison of the model temperature measured at Saint Sentin (44 M) showed similar measured services but a larger solar dycle dependence at Millatone Mill. The strong Ep-dependence found at Millatone Mill is attributed to the relatively light geomagnetic lactudes of this station.

J. Geophys. Ess., Elux, Paper Sangas J. Geophys. Res., Blue, Paper 340848

0460 (Traveling innoapheric disturbances)
LOCKTING TID SOURCES WITH A WORTH-SOUTH CHAIN OF
RAFID-MEN HONOSOHORS IN WESTERN QUINES
M.G. MORGEN (Radiophysics Laboratory, Theyer School of
Engineering, Darksouth College, Randwer, New Hampshire
03755

Engineering, Dermouth College, Handway, Innyer School of College, Handway, Haw Hampshire. Three rapid-run ionoscodes placed untually 150 km spart for determination of the vactor motion of TID's, spart for determination of the vactor motion of TID's, spart for determination of the vactor motion of TID's, superior of the characteristic spart and varant, were suggested with three mote ionoscopies laid out morthward superior for which devices TID's arrive at the New Hampshire-Vermont setup. Observations were made for the three month period 1987 March, April, May. In a preliminary scanner' technique to produce tentimous displays of witten height at suspected frequencies moderately below the Y-layer critical. These identifications the Phase second watfoom, with propagation word the three motors are desired. These for the three delays from the boy, a high degree of correlation some the three mesons watform, with propagation word the three high decreased of the three mesons are desired. An example, from 1980 observations, is whom, of the observation correlation over way deptime, hours of the observation of the statement of the correlation over way deptime, hours of the observation of the characteristic decrease with these predominant direction (south-shiftmant) teneral which

the fib's go. On the other hand, sources been a found to be located as little as 200 km operation the network. TID's and their causative gravity at the network. TID's and their causative gratique propagate northward from these sources as salls southward. The sources are evidently narrow is north-south extent for they frequently salls that the stations, upmend some 275 km apart, ulthout car absorption of innovenda signals at either adjuct station. However, when thou are located at microssounds station, they cause complete less them, thereby confirming that they are gones of compute partition precipination. They are believed to be to procipitation from the outer radiation bit. (Gravity waves).

O460 (Traveling ionospheric disturbance)
THE DISPERSION OF TRAVELES IONOSPHERIC DISPERSION
N.G. Morgan (Radiophysics Laboratory, Tagve Seeds
Engineering, Dartmouth College, Hanover, No. Seeds
03753

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Whoreas plots of observed valuaity vs. pariet, st.
F-region dsytims spectral-components of tracits
is anosphoric disturbancos, lead to widely scaling
points, a log-log presentation of valuations, the state of the state o

6720 Magnatic and electrical methods
EXPERIENCE WITH THE EN-60 ELECTROMAGNETIC STRING.
GROTHERMAL EXPLORATION IN MEWADA
M. Wilt CEATCH SCIENCE Lab. Lawrence parties to
Bidg. 90-1070, University of Galifornia, market
94720) M.E. Goldstein, W. Stark, J.B. Madght, market
Morticon

terroreses retriection trop the common datum point traveltime ensurements of the event. To underline the significance and consequences of this method, a derivation and discussion of geometrical apreading factors is now given for two- and three-dimensional each models with curved reflecting boundaries. The sprading factors can be used easily to transform of interface reflection coefficients, either directly or in connection with a true amplitude migration. A scinci section with true amplitude reflections can be discribed by one physical experiment: the tuned reflector model. Hence the application of the wave reflector model. Hance the application or the caption (in connection with a migration after stack) is justified on such a seismic section. Also the caption of the caption

Pad. Sct., Paper 380805

One Tides, waved and winds
100KK THERNSPHERIC STRUCTURE FROM MILLSTOK BILL
100KK THERNSPHERIC BILL
100

ionosphoric disturbances, less to revelength where points, a log-log presentation of wavelength where is a log-log presentation of wavelength where the set of the principal potential of the redundancy between the axes brises about any this redundancy between the axes brises about any considerable apparent, though illusory entirely at the points. The slope of the linear log-leg had the points. The slope of the linear log-leg had the and points. The slope of the limes and shall sha J. Gaophys. Res., Blue, Paper 3A0894

Exploration Geophysics

0920 Magnetic and electrical methods
SILCOTRODE CONFIGURATION INFLUENCE ON MEISTIFF.
MEASUREMENTS ABOUT A SPHERICAL ANNALY
R. J. Lytis (Lawrence Livermore Meatons Liberator).
94550) J. M. Hanson.
The trade-offs lavolved with school-face relatively
probleg are acudied for the case of a spacies
normally. In particular, two-, there, satisfied,
four-electrode configurations are investigated, the
four-electrode configurations are investigated,
there and four-electrode configurations have also the
trade acude and the second configuration of the
capabilician than does a two-electrode configuracapabilician than does a two-electrode configuration
force—borchole probing is supplied of delatively
acoustic tenditions at a greater range than desingle-borchole probing.
GEOFHYSIGS, Vol., 48, NO. 8

yer20) M.E. Goldstein, M. Stark, ","
Morrison
Lawrenge Berkeley Leberatory (13th) code; of
Lawrenge Berkeley Leberatory (13th) code; of
controlled-source electromagnetic (12th) entires to ide
goothermal prospects in northern Wesde to styling
demonstrate the applicability of hall's 22-16 reprinted
demonstrate that applicability of hall's 22-16 compet is
goothermal exploration. Daying the large empty
acrly fall of 1979, over 40 soundings were

matrices are defined. Using the two propagation invariants, a number of symmetry properties of the modified veilection and transmission matrices are derived. For loss less media a generalized Kunst and it remains and it remains a given. The modified reflection and transmission matrices are syressed in terms of the same invariant and in terms of the particioned aubmatrices of the propagator matrix and in terms of the usual reflection and transmission matrices.

I also derive the response of a buried point source for a layered modium bounded by two homogeneous half-space, and for a layered modium bounded by two homogeneous half-spaces. More general sources can be treated by superposition. In an appendix, I use multi-dimensional fourier transforme to derive the decomposition of a spherical wave into plane waves (the Mayl Integral) and into cylindrical waves the Monmerful diategral). Soft chess decomposition into traveling waves only, but an explicit form of the Whittaker integral represents a decomposition into the Mhittaker integral represents a decomposition into the Mhittaker integral represents a decomposition and transmission attrices do not exist in this case. This fact is used to derive dispersion relationships for channel waves and surface waves the such as channel waves and surface waves by requiring that cores in determinants shall be zero.

GEOPHYBICS, VOL. 48, NO. 8

Interval of the stronger on the wave field, as use defined the surface active compounds and transmission matrices and termination charters and the surface active compounds are altributed by different the surface active compounds are altributed by different and the adjustment that be defined and transmission matrices and a present and archange provided to different and the adjustment that be adjusted and transmission matrices and a present and archange provided to different and archange provided to diff

Fusion: Canyon (Grass Valley), ossi Vinnesucca; Boda Lake, pear Fallan and McCoy, west of Austin. Lake, pear Fallan and McCoy, west of Austin. Lake, pear Fallan and McCoy, west of Austin. The IM-60 is a Fraquency-domain system using the IM-60 is a Fraquency-domain system using the McCoy and Fallan and Imperial here, we applied '65 A to a 100-m diameter reported horizontal loop, generating a dipole moment for turn horizontal loop, generating a dipole moment only a ward a soundings at sole cascellation, we had a soundings at remaistra-receiver separations of up to 4 km over the transituar-receiver separations of up to 4 km over the transituar-receiver separations of up to 4 km over the transituar-receiver separations of up to 4 km over the transituar-receiver separations of up to 4 km over the purposes of the geothermal investigations. For the purposes of the geothermal investigations. Reparted apacter as interpreted by mans of simple moments of the purposes of the geothermal and in the field and by system cassactions are then compared with other resistable geologic/geophysical data ests for the available geologic/geophysical data ests for the available geologic/geophysical data ests for the available geologic/geophysical data ests for the available. Experience with the EM-60 system in Newada and agastatuluries for geothermal exploration. An average of two soundings per field day for daplar of application up to 2 km was obtained routinely.

Results from EM-60 work at Penther Canyon compare ver favorably with earlier dipole-dipole resistivity survey. At Soda Lakes, 13 held conductive hold associated with an area of high subsurface temperatures. In this case, the field clime required for the dipole-dipole resistivity survey. At Soda Lakes, 13 high-quality EM soundings were obtained from two pressitions. With the EM-60 data, we were able to map the depth to and inclination of a burled conductive hold associated with an area of high subsurface temperatures. In this case, the EM results confirmed an elevation differen

Geodesy and Gravity

the depth to and incitation of a burden considerate bedy associated with an area of high subsurface temperatures. In this case, the EM results confirmed an arise XT survey interpretation and gave additions distalled user-surface information. At the remote and santainess McGoy site, data interpretation was conjugated because of the rugged terrain, by modifying cristing interpretive software, we were able to elevate the effects of titled-nounce dipoles and elevation differences on moundings and thus interpretates. The EM soundings detected a conductive axone at eight of 200 mat the south end of the prospect, where a sarrhy drillhole had encountered water at 100°C at the same depth. In addition, EM soundings at McGoy provided information on a deep conductor below 2 km which has yet to be drilled.

COMMINICS, VGL. 46, BD. 8**

COMMINICS, VGL.

Meteorology

prosetrical pressing factors that are derived can be lobed upon as a generalization of a well-bown formula fewam, 1973), which is commonly used in true spitude processing and trace inversion in the presses of a vertically inhomogeneous earth. COPEYSICS, VOL. 48, NO. 8

1. K. Bickel (ARCO Oll and Gas Cn., P.O. Box 2819, Idlies, TK 75221) D. R. Marticez To logrows the resolution of seismic events, one office designs a Viener inverse filter that optimally

site designs a Viener inverse filter that optimally in the least-squares sense) transferse a sessured ince signature into a spike, When this filter is spiled to saissic data, the bandwidth of any noise with is present increases along with the bandwidth of its signal. Thus the signal-to-moise ratio is degraded. In reduce signal ambiguity it is common practice to reduce signal ambiguity it is common practice to reduce signal ambiguity it is common practice to reduce stall whener filter. Prawhitzening the filter hyperes the output signal-to-ambient noise ratio, but it has seen time it reduces resolution.

The shility to resolve the temporal separation hisses awants is determined by the resolution time instead events its determined by the resolution time was stalled to the second of the second

nd the off-diagonal submatrices are more all the results in the paper are derived from the impair properties of this general equation. In the impair properties of this general equation. In the impair properties of the general equation in the impair properties of the properties of the impair properties are all the represented by seven, accounted waves, and this represented by an equation with the same Theoreties.

eteck of inhomogeneous layers bounded above by marface, modified reflection and transmission

4410 Secondic methods
LLSSUTION PERFORMANCE OF WIKNER FILTERS

3715 Chemical composition and chemical interactions WETPALL CHEMISTRY STUDIES AROUND A LARGE COAL-FIRED POWER PLANT IN THE SOUTHEASTERN WHITED STATES A. A. N. Patrices (Browshaven Marional Laboratory, Upton, New York 11973) M. Tarry Dame and R. S. Saylor A wee(all chemistry study was conducted within a factor which a farmer was fired power plant in Electron and Company of the conducted within a

Filipse of resolving power recently described by Filipse (1921). For matched filter signals the Milwing state the resolution the constant can be regarded as the inverse of the improvement of the signal. Although it is intelligent the resolution the constant definition grass with other measures of rusolution, this mure learning that the resolution the constant definition grass with other measures of rusolution, this mure leastly sensive the self-sinition has two major advantages. First, it is corporate the offects of noted by assuing that the filter is a Viener filter.

For a given smount of noise the Wiener filter is a leastly sensive the resolution of a Wiener filter is a viene situation of the matched filtur, Marine seismic washers the resolution of a Wiener filter relative to accept the resolution of a Wiener filter relative to indictability for these wavelete a polnt of indictability for the wavelete a polnt of indictability for the sensity of the conduction of a wiener filter relative to distribute the correct and the resolution, a large increase in large relative to maintain largerately information at the output.

OFFINATION OF ELASTIC AND ELECTROMAGNETIC WAVE PROPAGATION IN TRANSICOLUTELLY LAYERED MEDIA increased by the conduction current with a special many circumstances to yield a simplified, linear, mathematical description of simplified of this paper is to provide a unified treatment of size its and electromagnetic (EM) wave froggeting in harimontally layered media for which the propagation in harimont "Neverth of resolving power recently described by Midese (1921. For matched filter signals the stabulen time constant can be regarded as the inverse of the frequency span of the signal. Although it is mislying that the resolution time constant definition grass with other measures of rusolution, this more ideal stabulents and the stabulents of the stabulents of the stabulents of the stabulents of the sample second, it is easily sensralized to incorporate the offects of noise by assuming that the filter is a Wiener filter.

For a given smount of soise the Wiener filter is a Measurisation of the watched filter. Karine seismic useders demonstrate how reducing the noise lavel improves the resolution of a Wiener filter relative to a satched filter. For these wavelets a point of similaring return is reached, such that, to realize a further small increases in resolution, a large increase is layer signal-to-noise ratio is required to maintain interpretable information at the output. oppose to be small unless the ionization rate is en-appase to be small unless the ionization rate is en-hanced by a large factor within the plant canopy. (Electrode effect, convection current, interfacial transfor, conductivity).

1765 Burface waves, tides, and see level PREQUENCY ARALYSIS OF WAVE REIGHTS BASED ON WAVE ENVELOPE

FREQUENCY ARALYSIS OF WAVE RETORYS BASED DN WAVE
ENVELOPE
M.A. Tayfum (Civil Engineering Department, Kuwmit
University, F.O. BOX 5959, Kuwmit)
Analysis and prediction of the beights of sea waves
in terms of a conventional creat-to-trough definition
present practical and theoretical difficulties. As a
closely related atternative, the envelope of waves oan
directly be used as a reference for a wave beight
measure which is continuous in time. This concept is
explored to show that not only it is consistent with
the theoretical approximation of irregular waves but
that it also provides a remarkably efficient approach
for the frequency analysis of wave heights in typical
case abody reveni that the proposed approach gamerates
frequency estimates which are improved in statistical
frequency estimates which are improved in statistical
quality and compare batter with the available theories
on the distribution of wave heights.

J. Gauphys: Bas., Green, Paper 20085 The symmetry properties of the system matrix are used to derive simplified equations for computing the propigator matrix for a stack of inhomogeneous layers. He wave field is also decomposed into upgoing and douging waves by a signovector decomposition which is note simplified compared with the general case of a decomposition in a suitable starting point for deriving different order. These approximations of splicetions in general and WKB-approximations of splicetions in generalized migration schemes. These approximations of the properties of the system actrix. One of these constructions in generalized migration schemes.

J. Gasphys. Res., Green, Paper 300985

conservation of sharge, the conservation of sharge, transmission and talked at tack of inhomogeneous layers, transmission and talked natives for upward and downward propagation so defined. Using the two propagation invariants, a transmission matrices for two propagation invariants, a transmission matrices and transmission matrices and relationship the propagation matrices and relation and transmission matrices and relations and transmission matrices to two product that composition rule has been derived for deprending unknown in asismology, is also given. This is relatively unknown in asismology, is also given. This is relatively unknown in asismology, is also given. This is relatively unknown in asismology, is also given. This is relatively unknown in asismology, is also given. This is relatively unknown in asismology, is also given. This is relatively unknown in asismology, is also given. This is to the think the talked the top or bottom of a stack of applications in Semeral invariant school matrices. It is a late as is a stack of the product of the prod ad 4765 Surface waves; rides, and mes level

ATTERNATION OF CAPILLARY AND CHATTY HAVES AT SEA BY

MONOMORICULAR ORDANIC SURFACE FILES

HIMMORTHUS (Interface the Organische Chemis der Uniwersiele Hamburg, Martin-Luther-King-Plat &,
2000 Hamburg 13, F.k. Germany), W. Algors, W.D. Gerret;
During the MARSEN 79 experiment attemustion of capitburing the MARSEN 79 experiment attemustion of capitone methyl cleate purface film ("mick") was inventone methyl cleate purface film ("mick") was inventgenes significant! A methyl pleate silch causes only
becomes significant! A methyl pleate silch causes

J. Gelphys. Rus., Blue, Papar languo

THE VARIATION WITH PREQUENCY OF THE LOSG-PYPIOD TIDES

J. A. Carton (Center for Earth and Planetary Physica, Marvard University, Cambridge, Mass., 02118)

The ocuante response to long-period tidal furcing in closed basins approaches equilibrium for perioda much longer than a month, for moderate values of dissipation. At a given frequency the response is closest to equilibrium near the eastern wall of the basin. Global calculations of the IV and 22 tides using a 20 x 2 grid are presented. Changes in the langth of day have also been computed for these tides (Long-pariod tides, baroarropic morion).

J. Geophys. Pes., Green. Pager 100981 J. Geophys. Pes., Green, Paper 30098

App denoral (Subble Persistance)
THE PERSISTENCE OF AIR NUMBERS AT A DEAVATES OFFICE Scott R. Furger and Funcan C. Blancher! (Attropheric Sciences Research Center, State University of liew form at Allany, Albany, Y. 1.727)
The time an air bubble prejate at a servator surface is a numerion of ray factors, including the relative handlifty and speed of the air own the surface of the water. We find that hubble surface life increases in regulated with dereasing burdlifty and increasing speed of the sir. This approva to be caused by a satisfic preddict along the ratio cap. This produces a cuffice tension gradient (Paragona) offset) duces a curface tension gradient (Marsages) effect) that increases builts surface life.

Particles and Fields— Ionosphere

5505 Airglov ELECTRON-LHPACT OF O1 17990 & MULTIPLET P. V. Erdann (Repertment of Physics and Astronous, University of Pittsburgh, Pittsburgh, PA 15260) and E C. Zipf

Ve have investigated the dissociative excitation of the arcoal coyeen multiplot 0113e⁻¹ p⁰ · p¹ p⁻¹ p⁻¹ 1990 A dissociative excitation of the arcoal coyeen multiplot 0113e⁻¹ p⁰ · p¹ p⁻¹ p⁻¹

Seylor.

A swt(all checitaty study was conducted within a liver radius of a large coal-tired power plant in the southeastern instind States. The study was conducted during the winter of 1981 and included event presentition of a large coal-tired power plant in the southeastern instind States. The study was conducted during the winter of 1981 and included event presentition is consulted and included event presentition is consulted and included event presentition of 80, visitaling an upper limit cross section of 100, visitaling an upper limit cross sectio J. Geophys. Rec., Blue, Paper 3AD999

STID High-Latitude innospheric currents
EMERGY DISSIPATION RAYES IN THE POLAR IDMOSPHERE
B.-E. Ahm (Geophysical Institute, University of
Alaska, Fairbanks, Alaska, 19701), A.-F. Akasefu and
Y. Kamide
As a part of the jeint effects of operating six
meridian choise of asgustometers during the 185,
magnatic records from 71 notations are used to deduce
the distribution of electric fields and corrents in
the polar isnosphere for March 17, 18 and 19, 1978.
As a contionation of this project, we have constructed
hourly distribution maps of the Joule here production
rate, the particle energy isention rate and thair sus
over the satire polar region on the three days. For
this purpose the conductivity distribution is inferred
at each instant particlely on the basis of an empirical at each instant partially on the basis of se empirical mathod devised by the et al. (1982). The particle sented devised by the et al. (1982). The particle empray eigentles take is satisfacted eighterly using an empirical sathod. The date set thus obtained allows us to estimate also the global Joule heat production rate U, the global particle energy imjection rate U, and the our U, of the two questities. Et is found that the three global questities (weet) are related almost linearly to the AK(eT) and AK(eT) indices. Our present estimates give the following relationships: U, -2.3 x 10° · AK, U_A -0.6 x 10° · AK and U, -2.9 x 10° · AK, U_A -0.6 x 10° · AK and U, -2.9 x 10° · AK. U_A -0.6 x 10° · AK and U, -2.4 x 10° · AK. U_A -0.6 x 10° · AK and U, -2.4 x 10° · AK. U_A -0.6 x 10° · AK and U, -2.4 x 10° · AK. U_A -0.6 x 10° · AK and U_A -3.8 x 10° · AK. U_A -0.6 x 10° · AK and U_A -2.4 x 10° · AK. U_A -0.6 x 10° · AK and U_A -2.4 x 10° · AK and U_A -2.4 x 10° · AK. U_A -2.5 x 10° · AK and U_A -3.8 x 10° · AK and U_A -3.

J. Gauphys. Res., Plus, Paper 3A0531

SSAS Inneapher is disturbanes
OBERVATION AND MODELLING OF MULTI-PREDUBLY VAF and
OBERVATION AND MODELLING OF MULTI-PREDUBLY VAF
OBER SCHWILLATIONS IN THE EQUATORIAL REGION
S. J. Franks (Department of Electrical Engineering,
University of Illinois at Orbana-Champaign, Drhoma,
Illimois, MiSO), O. H. Liu
Amplitude scintillection peocify and statistics obtoined scintillection peocify and statistics obtoined scintilmoisty of VEY (237.35 Mms), L-band
(1541,5 MMs) and G-band (1941.5 MMs) from the MARIGAY
communication scintille (15'4) or presented. The
manuscrambits were made at Ascention learnd (1'84's),
May 21'd, 10's BTP) aver a high Elevation propagation
path within a few degrams of the magnetic medicion Le'22's, 10's Str) over a high alevation propagation path within a few degrams of the magnetic medician plane. The multi-fraquency dath and the unique propagation geometry smalls on to study the effectives of the equatorial innohistion in used to modul a specific event. Comprisons between the modeling results and the observations indicate that the data are consistent with the raneutly shausered (in-str) two component power lab translations are strongly shausered (in-str) two component power lab translated that the data are consistent with the raneutly shausered (in-str) two component powers by the strongly of the strongly shausered (in-str) two component powers to the strongly shausered (in-str) two component powers are the strongly of the strongly shauser of the strongly shauser of the strongly shauser than the shauser than the strongly shauser than the shauser than

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5560 Particle Procipitation ALTITUDE AND STRUCTURE OF AN AURORAL ARC ACCELERATION

ALTITUDE AND STRUCTURE OF AN AURORAL ARC ACCELERATION REGION

6. Paschmann (Rax-Planck-Institut für extraterrestrische Physis, 8046 Garching, N-Germany), J. Paparastorahis, N. Sckopte, G. Haerendel, E.G. Sholing During a rocket flight in the dayside auroral oval on 17 December 1974, several examples of velocity dispersions of precipitating electrons user observed. It is shown that the commonly employed interpretation of such dispersions as resulting from a purely temporal modulation of the source is not unique: the same dispersion effects can also be caused by a rowing source of finite uidth, and constant intensity. This spatial model is further incrowed by adding the dispersion originating from a superioposed convection velocity. In general the course altitudes implied by the two models (Lengoral and spatial) differ. For non of the creats analyzed the temporal model yielded a source altitude of -3000 km. Recause of special circumstances this did not differ significantly fines the result obtained with the spatial endel. The second case analyzed was inconsistent with the temporal model and required further rediffication of the spatial model and required further rediffication of the spatial model to include an energy dependent source width, in line with expectations from an acceleration in a Y-shaped electric field patien. Regional electron acceleration).

J. Homphan, Resign Rule, Paper 19916

1963 Plasmo motion, convection, or circulation IONOSPHERIC PLASMA RIBBLE ENCOUNTERS OF F REGION

No.5 Planna nation, consection, or circulation incosphere PLASA BIBBLE FROUNTIES or FARDICE MOTOMSIDE TRAVERSALS? Mobert F. Senson (PASA/Moddard Space Flight Court, Laboratory for Phinotary Atraspheres, Greenhelt, MD 2071) and Henry C. Brinton in size AFC and AECE ion composition consurement, together with Mantle and hasacean tensonde electron density profiles, are used to an attempt to distinguish between spacestait encounters with equatorial plant tubbles which have been pinched off from telow, those still in the formation stage, and injunctively the stage to distinguish between spacestait encounters with equatorial plant tubbles which have been pinched off from telow, those still in the formation stage, and injunceraft excursions can fit be past-summet. Flayer - Such securation on result from quasi-periodic restillations of the stated of the Flayer - as defined from the intensition catalities ACCE, it is found start depletion factories that appear to be included biblios which have been pinched off from below added highles which have been pinched off from below added highles which have been pinched off from below added highles which between the desire is high as a factor of 10° in the former gase 0° remains the dominant ton, in the latter case 50° after become dominant. These results have important theoretical implications in that the and consistent with placing the bubble generator results.

J. Geophys, Ros., Blue, Paper JA0393

5563 Places cotion, econocition or circulation to parallel Electric Field Effects on Plasma Jelino. J. L. Sperling (JAYCOR, P.O. Box 81154, San Diego California, 92138)

J. L. Sperling (JACOR, P.O. Bon 88154, San Diege, California, 92136)
The cochination of ion-Federaun currents and parallel electric fields are shown to significantly affect both the jetting of homospheric plases clouds transverse to the geomagnetic field and the Alfven waves generated by the cowing plasma. lon-Pedersen currents and parallel electric fields invalidate the "froran-ta" field approximation and causa Alfven waves to dacay. They sleo imply an eigenvalue condition on the size of the plasma cloud transverse to the geomagnetic field and the direction of cloud motion. The attenuation of Alfven waves reduces the likelihood that the waves can causa an electromagnetic prise on the ground and implies that the initial directed energy in the plasma jat is coupled, over great distances, to ions and electrons. It is suggested that two phanomen are more lifely to occur at higher altitudes (e.g.,) 500 km), where neutral and subtent dessities become smaller, first, there is the aubstactal displacement of plasma clouds with an accompanying temporary change in the geomagnetic field. Second, the Alfvent waves created in response to the sotion of plasma clouds are less subject to attenuation and more likely to cause an electromagnetic pulse on the ground. the grouse: J. Geophys. Pes., Blue, Paper 3AD979

5563 Pissua cotion, convection, or circulation a comparative STUDY OF VHF SCINTILLATION AND SPREAD F EVENTS OVER MATAL AND FURTALEZA IN BRAZIL R. T. de Medeiros (Universidade Federal do Río Grande Norte, 59000 - Natal, RN, Bresil), H. A. Abdu and

do Norte, 59000 - Natal, RN, Bresil), m. a. now and I. J. Kantor A comparative study is carried out of the equatorial ionospheric irregularity occurrences, as observed by range spread P events over Fortaleze (408, 3854, dip latitude 1.80) and sarelitie vor eigens scintilization event over Matal (5.898, 33.2)04, dip latitude 4.805) for a one-year period, 1978. Close seculation is observed in the accurrences and the durations of the irregularities at the two stations. Marked difference in the scesams behaviour of the accurrences of the irregularity events over those two stations are noted in the scenarial behaviour of the occurrences of the irrogularity owners over those two stations are noted with respect to that over Husneaga, most important of them heigh that while the latter station presents equiportal marks in the occurrences rates (as over two African stations), the Brazillan stations show an additional and pronounced peak in December. This result is explained as possible evidence of taggetto declination control of the spread F irregularity generation and its seasonal dependence. The present results have important implications also on the occurations of different irregularity scale sizes during equatorial pleases bable irregularity scale sizes during equatorial places bable irregularity scale sizes during equatorial places bable irregularity, scale sizes during equatorial control).

1. Leophys. Pes., Blue, Paper 3A0730

J. Leophys. Pess, Blue, Paper 140730

5199 Goores (ray tracing)
INTERPRETATION OF INNOCRAMS IN THE VICINITY OF THE
BAYSIDE GRAL BY BAY TRACING
N. Rieg (Nar-Planck-Institut (Gr Aeronosis,
p-341 Katlenburg-Lindeu, Mest Cormany), and E.
Hometon

p-1411 Katienburg-Lindeu, Nest Cermany), and E. Wagstrap
A ray tracing program based on the Madlegrove equations has been developed and used to synthesize ensus Ecquency foragrams. We have analysed integrams taken in manner periods in the vicinity of the depilde surveral cost. Especially the obitque reflection traces on high latitude foragrams from a field aligned sleeteron density submeasant have been studied. Ray paths in the asgustle maridian plans are malculated and discussed in congramation with computed and observed foragrams. The cay tracing exarcise shown it is possible to intimate chracteristics of field aligned electron density cohescewart. From observed foragrams By many characteristics of ritard alignan electron dansity enhancement from charved important. By varying the persenters in the model of the icon-aphare it is possible to easily to temporal and sp-itle progress of an electron dansity enhancement that could be a feature of the hoteral evel like the field sligned current sheets in the cusp ro-gion. (locograms, excess) rough, field aligned electron density achierments).

455

Red, Spi, Paper 190793